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OF

FORESTRY,

AGRICULTURE, SHIKAR & TRAVEL.

EDITED BY

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CONTENTS OF VOL. XIII.

1887.

No. 1.—January 1887.

I.—Articles, Correspondence, &c.— PAGE.

Visit to the big trees of Mariposa and to the Yosemite Valley, California, America, ... 1
Three descriptions of the State Forest of Tronçais (Allier), 10
Fencing of Reserves in Jeypore, ... 26
Students from the N.-W. Provinces at the Forest School, *ib.*
Lists of Forest Officers, ... 27
Preservation of India Rubber Tubing, ... 28
Fires in Forests, ... *ib.*

II.—Review—

Forestry in the Punjab, ... 29

III.—Notes, Queries and Extracts—

Forest Management at Simla, ... 39
Forest Meteorology, ... 44
The re-afforesting of Ireland, ... 49

No. 2.—February 1887.

I.—Articles, Correspondence, &c.—

The Forests of the outer North-West Himalaya, ... 51
A Rhyming Report of the Forest Conference at Dehra Dun, 70
The Cultivation of a Wood for Tea Boxes, ... 73
Future Organization of the Forest Department, ... 76
Dr. Mayr's visit to India, ... 79
Note on Bamboos, ... 80
Germination of Babul seeds, ... 82

II.—Review—

Report on Government Botanical Gardens and Parks, Nilgiris, 1885-86, ... 83

III.—Official Papers— PAGE.

Memorandum on the Forests of the Nahan State, Punjab, 85
Note on the Destruction of the Black Weevil, ... 87
Retirement of Col. W. Peyton, ... 89

IV.—Notes, Queries and Extracts—

Dr. Aitchison on Plants and Plant Products of Afghanistan, ... 90
South African Stink or Sneezewood,... 95
Felling and Trucking in Forests, ... 99
Wooden Pavements, ... 84

No. 3.—March 1887.

I.—Articles, Correspondence, &c.—

The Indian Forest Service, ... 101
Tabasheer, ... 107
Grazing in Forests treated on the Jardinage System (Selection Fellings), ... 115
List of Trees in the Melghat Forests, ... 119
Future Organization of the Forest Department, ... 122
A High Forest of *Quercus dilatata*, ... 124
Misuse of a Standard Book, ... 125
Fires in Forests, ... 127
Shikar, ... 128
Sneezewood, ... 129

II.—Review—

Report on the Forest Administration of Lower Burma for 1885-86, ... 131

III.—Timber Market—

Churchill and Sim's Wood Circulary 136
The Teak Market, ... 138

IV.—Notes, Queries and Extracts—

Rab,... 139
Climate of Manipur, ... 145
Arboriculture on the Suleiman Range, ... 147
India-rubber, ... *ib.*

No. 4.—April 1887.

I.—Articles, Correspondence, &c.—

The System of Forest Management in Switzerland, ... 149

PAGE.

A Tour in the Salt Range, ... 157
Early Days in Assam, ... 163
Wall-Pictures to illustrate the minute Structure of Plants, 168
Forestry and Forest Organization, ... 171
Forest Denudation in Tihri Garhwal, ... 172
Public Service Commission, ... 173
Rhyming Report of the Forest Conference, ... 175
Indents for Timber by the Public Works Department, ... 176
Forest Pests, ... *ib.*
Sowing and Planting Bamboos, ... 177
Germination of Babul Seeds, ... 178
A real Weeping Tree, ... 179
The Indian Forest Service, ... *ib.*
Clearing Fire-lines of Forest growth, ... 180

II.—Official Paper—

Cooper's Hill College, ... 181

III.—Notes, Queries and Extracts—

Tabasheer, ... 185
Destruction of Game in Government Reserves during the Rains, ... 188
Hybrid Potatos, ... 190
The Preservation of Fish in the Punjab, ... 192
Our Forest Laws as they are made applicable to Government Reserves, ... 194
Supplying Walnut to Government Departments, ... 196
The Sale of Oil in Sweden, ... 180
Nettle Tree, ... 184

No. 5.—May 1887.

I.—Articles, Correspondence, &c.—

The Indian Forest Service, ... 197
Our Empire of Rivers, ... 198
Sissú Planting in the Gorakhpur Forests, ... 213
Dateyah Jeypur, ... 218
A New Sport, ... 222
Clearing Contour bands through Deodar Forests, ... 224
Germination of Babul Seeds, ... 225
Clearing Fire lines of Forest growth, ... 226
Germination of Babul Seeds, ... 227

II.—Official Paper—

Note on the Government Forests of Bahraich, Oudh, ... 228

PAGE.

III.—NOTES, QUERIES AND EXTRACTS—

The Madras Forests, ... 241
Game Preservation and Forest Laws, ... 242
Closing Government Forests, ... 244

No. 6.—June 1887.

I.—ARTICLES, CORRESPONDENCE, &c.—

A Forest Tour in Provence and the Cevennes, ... 245
First impressions of Burma, ... 256
Code Headings, ... 261
Tiger and Peafowl, ... 262
Grading of Forest Rangers, ... 263
Maljhan Fibre for Paper making, ... 264
Planimeters, ... *ib.*
Clearing Contour bands through Deodar Forests, ... *ib.*

II.—REVIEWS—

The Edinburgh Forestry Exhibition of 1884, ... 265
Report on Forest Administration in the Hyderabad Assigned Districts (Berar) for 1885-86, ... 273
Report of Forest Administration in Baluchistan 1885-86, 277

III.—NOTES, QUERIES AND EXTRACTS—

The Box, ... 282
Transmission of Seeds from the Tropics, ... 285
Girdling Trees for Fruit, ... 286
Sabe, Sabai, or Babur Grass, ... 288
Wood Spirit, or Pyroxylic Acid, ... 289
Fungi on Roots of Tea Bushes, ... 290
Forest Organization for Beginners, ... 291

No. 7.—July 1887.

I.—ARTICLES, CORRESPONDENCE, &c.—

A Forest Tour in Provence and the Cevennes, (concluded,) 293
Elephant Catching in N.-W. Provinces, ... 304
Forest Fire near Murree, ... 312
A Note on an Oak of the N.-W. Himalaya, ... 318

PAGE.

Ring Countings on Deodar stumps at Deota Forest, Tihri Garhwal, ... 320
Sissu Planting, ... 321
Pyroxylic Acid, ... *ib.*
Length of Tigers, ... 322
Large Simal Tree, ... *ib.*
Compounding Forest Offences, ... 323
Germination of Babul Seed, ... *ib.*

II.—Official Papers—

Forest Settlements, ... 324
Note on the Question of the Admission of Natives into the Indian Forest Service, ... 332

III.—Notes, Queries and Extracts—

Trees for Saline Soils, ... 339

No. 8.—August 1887.

I.—Articles, Correspondence, &c.—

Forestry in France, ... 341
Tour through Colorado and visit to Ottawa City, America, 355
Imports of Timber into Burma, ... 359
The Indian Forest Service, ... 361
A Fillip to Senior Anglers, ... 363
A Plea for Systematic Botany, ... 365
New entries at Forest School, Dehra Dún, ... 366
Compounding Forest Offences, ... 367
Recording Evidence in Forest Offences, ... 368
Compounding Forest Offences, ... *ib.*
Water-spout at Jalpaiguri, ... 369
Length of Tigers, ... *ib.*

II.—Reviews—

American Woods, ... 370
Forestry in Assam, ... 371
Forestry in the Khasi Hills, ... 381

III.—Notes, Queries and Extracts—

The Agricultural Pests of India, ... 383
The Agricultural Pests of India, ... 387
Fungi on Tea Roots, ... 388
Re-organization of the Forest Department, Ceylon, ... 382

No. 9.—September 1887.

PAGE.

I.—ARTICLES, CORRESPONDENCE, &c.—

Forestry in France, (continued,) 389
Forest Settlements, ... 403
Systematic Botany at the Forest School, ... 405
Use of Semal Wood for Packing Cases, ... 406
Dehra Dun Fishing Association, ... 407
Visit of M. Usséle to India, ... 408
Seeding of Bamboos, ... 409

II.—REVIEWS—

The Bombay Forest Commission, ... 410
Forestry in Bombay, ... 429
The Forest Survey during 1885-86, ... 436

III.—NOTES, QUERIES AND EXTRACTS—

The Indian Forest Budget for 1886-87, ... 438
Agricultural Pests of India, ... 437

No. 10.—October 1887.

I.—ARTICLES, CORRESPONDENCE, &c.—

Forestry in France, (continued,) 439
Compounding Forest Offences, ... 451
Periodical Rain-gauges, ... *ib.*
Squeaking Caterpillars and Moths,... 452
Forestry in Ceylon, ... 453
Bamboos for Lance-Staves, ... *ib.*

II.—REVIEWS—

The Bombay Forest Commission, (concluded,) 454
Forest Report, Bengal, 1885-86, ... 475
Civil Funds for Cooper's Hill men,... 478

III.—NOTES, QUERIES AND EXTRACTS—

Cooper's Hill Prize Day, ... 479

No. 11.—November 1887.

I.—ARTICLES, CORRESPONDENCE, &c.—

Forestry in France, (continued,) 489

PAGE.

Notes on a Forest Tour in Bavaria, ... 501
Memorandum on Teak sowings in Flowered Bamboo Forest, ... 512
Bombay Forest Commission, ... 517
Forest Technical Terms,... 519
Notes from Scotland, ... 520
Bamboos for Fishing Rods, ... 522
Annual yield expressed in trees instead of in cubic feet, 523
The Woodcock, ... 524

II.—Notes, Queries and Extracts—

The "Chos" of Hoshiarpur, ... 525
To Remedy past Neglect, ... 530
The Floods at Saharanpur, ... 534
To fix Indian Ink Drawings, ... 536
Welsh Mountain Fires, ... *ib.*

No. 12.—December 1887.

I.—Articles, Correspondence, &c.—

Forestry in France, (concluded,) 537
Notes on the Chindwin, Upper Burma, ... 546
Notes on a Tour in the Forests of the Austrian Salzkammergut, ... 556
Effects of Fire Protection on Sál Forests in Oudh, ... 565
The Forest Question in Australia, ... 570
Forest Technical Terms,... 574
Compounding Forest Offences, ... 575
Compounding Forest Offences, ... 576
Reproduction of Bamboos, ... 577
Notes on Forestry, ... 578
Deodar Reproduction, ... 579
Seeding of Bamboos, ... *ib.*

II.—Notes, Queries and Extracts—

Forestry, ... 580
Forest Officers in the Central Provinces, ... 583
Reserving Private Forests, Darjeeling, ... 584

Extracts from Official Gazettes— i

Dehra Dún, 29th December, 1886.

To

LIEUT.-COL. J. CAMPBELL-WALKER,
Conservator of Forests,
Southern Circle, Madras.

DEAR SIR,

IN reply to your enquiry regarding the probable duties of a Sub-Editor of the "Indian Forester," I write to say that, in order to increase its usefulness, I have long wished to secure the assistance of one or two Forest officers, in each Province in India, as Sub-Editors.

Every Sub-Editor, besides sending original papers for publication, would, as Mr. Peet has suggested, collect, arrange, or reject papers received for publication from friends, especially from his own Province, and would forward approved ones to the publishers direct, and correct their first proofs, or if he preferred to do so, he might forward manuscripts to the Editor, who would himself see to their publication.

In every case, the arrangement of papers in each number of the "Indian Forester," and the final revision of the proof, would rest with the Editor, who would retain the right of rejecting or postponing the publication of papers received from Sub-Editors, though such a right would certainly be but rarely exercised.

Every Sub-Editor would also forward to the Editor, a monthly letter referring to any matters of general interest, which recently occurred in his own Province, or elsewhere, and from these letters, a general monthly note would be drawn up by the Editor and published.

Sub-Editors would also endeavour to promote the circulation of the "Indian Forester," and would of course obtain a free monthly copy for themselves, and a share in the annual profits of the publication, if at any time, the receipts should exceed the expenditure; which has not occurred since I took over the management from Mr. Gamble, in 1882.

If, however, every gazetted Forest Officer in India, would support the "Indian Forester," a fair surplus might be expected, even if more than is at present possible were done in the way of publishing photographs and other illustrations, and thus Sub-Editors might receive a slight remuneration for their trouble, though it would be for the most part, but a labor of love.

It is highly useful to increase, as much as possible, the number of copies sold at half rates, to Rangers and other Members of the executive and protective staff of the Forest Department, although their sale does not cover the cost of publication, and when gazetted Forest officers throughout India know that the editing of the "Indian Forester" is carried on gratuitously, at the cost of much time and trouble, I feel sure that, they will one and all forgive the many errors, and occasional want of consideration shown for individuals, which hasty editing, whilst engaged in responsible official duties, has occasioned, and will give their hearty support to a work solely intended to advance the interests of Indian Forestry.

I am sending a copy of this letter to Mr. Peet, and to the other gentlemen whom I hope to induce to become Sub-Editors, whose names I hope to publish in the February Number of the "Indian Forester."

I will conclude this letter by expressing a hope that, after any one has consented to assist in editing the "Indian Forester" that, should he hereafter be unable or unwilling to continue on the staff, he will kindly inform me of the fact, and arrange, if possible, for a successor from his own Province. I must also thank you for reviving the question of Sub-Editors, and for the interest you always show in the success of the "Indian Forester."

Yours truly,

W. R. FISHER,

Honorary Editor, "Indian Forester."

THE

INDIAN FORESTER.

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VISIT TO THE BIG TREES OF MARIPOSA AND TO THE YOSEMITE VALLEY, CALIFORNIA, AMERICA.

EARLY in June last, I started from San Francisco in order to visit the renowned big trees of Mariposa, as well as the far famed Yosemite valley, which are both situated in the Sierra Nevada mountains about 200 miles south-east of San Francisco.

After crossing the bay of San Francisco by means of a fine ferry boat, I took train and proceeded to a place called Raymond, distant about 200 miles in a south-eastern direction, and which place is at present the nearest terminus for travellers *en route* for the big trees and for the Yosemite valley.

For the first 175 miles, or as far as the Berenda station, the line runs through an undulating and well cultivated country dotted over with numerous neat farms. All the fields are well fenced, wheat appearing to be the principal crop cultivated, and at the time of my visit the harvest was just commencing. This part of California is hot and somewhat dry, and subject it is said to severe droughts, but efforts are now being made to utilize the water of several of the rivers for irrigation purposes, by means of a system of canals in the same way as has been done in some parts of India.

As a matter of course, all natural forest has been cleared in the neighbourhood of the railway, but near all the stations along the line, and round about the farms, fine groves of a species of Eucalyptus have been planted, and the trees seem to be flourishing.

As expected, I found the system of travelling on the American railways most luxurious, the Pulman cars running very smoothly, and the carriages provided with double windows to keep out the dust.

Several cars in each train are also fitted with sleeping accom-

modation of the most complete kind, and in all carriages there is always a reservoir of pure iced water.

As far as my experience went, I only found dining saloon carriages attached to trains west of the rocky mountains, but great care is always taken in America when passengers cannot obtain refreshments on board the trains, to time the arrivals at the bouffets at suitable hours.

The next morning about 7 A.M., I arrived at the railway terminus of Raymond, which was found to consist of a temporary wooden shanty and tents pitched in the middle of the jungle. After breakfast and various anxious enquiries on the part of the more nervous of the travellers as to the probability of meeting with brigands *en route*, we started in open cars drawn by six horses for Wa-wa-ona, or the big tree "ranche," which is the nearest hotel from which the mammoth trees can be visited.

The first part of the road for a distance of about 12 miles, runs through an undulating country much resembling certain portions of Central India, after which, the base of the Sierra Nevada mountains is reached, where the country becomes more hilly and picturesque. The road is unmetalled, and as there had been no rain for two or three months the dust was quite appaling.

The geological formation appeared to be mica schist, and this part of California contains a fair amount of gold, and one or two mines were passed which were said to be flourishing.

About 25 years ago, when the mania for gold digging in California was at its height, this portion of the country was the scene of much excitement and disappointment to those in search of the precious metal, and numerous pits and scratchings are everywhere visible, all over the valley and hill sides. The vegetation of the country lying between the railway and the foot of the Sierra Nevada mountains is somewhat of a dry and stunted nature, and consists of the following trees and shrubs, the scientific names of which I have not been able to discover. Willow pine, a large tree resembling the *Pinus longifolia* of Northern India; white or live oak, buck-eye, a large bush with beautiful bunches of white flowers, also what appeared to be several species of *Rhus*.

Amongst flowering plants I observed lupins, larkspur, *Clarkia*, sunflowers and blue bells, as well as many other European species.

On ascending the slopes of the Sierra Nevada mountains, most of these species disappear, and the yellow pine, the bastard cedar, began to appear, as well as a beautiful species of *Cornus*, also a shrub called *Mansanita*. This bush has peculiar red bark and pink bell-shaped flowers, and the wood is much appreciated for walking sticks.

About 15 miles from the railway terminus we crossed a branch of the Merced river, along the edge of which a "flume,"

or timber slide, has been constructed by the Californian Timber Company, the bed of the stream being rocky and water sometimes scarce, which renders it unsuitable for floating purposes. This Company is said to have purchased from Government 15 years ago about 50,000 acres of pine and cedar forest, at 5 dollars, or about £1, per acre, and the object of the slide is to facilitate the exportation of the timber from these forests to the railway.

The total length of the slide is 58 miles, the upper depôts being situated in the Sierra Nevada mountains, whereas the lower depôt is at Madera on the railway line. From the casual glance I obtained of it *en route*, this slide appeared to be constructed of 2 inch planks throughout, the section being 2 feet at the bottom and about 3 feet at the top.

The planks or beams are fixed into sleepers, which are either embedded in the ground or supported on trestles whilst crossing ravines. The gradient appeared to be very slight, probably not more than 1 foot in 100 feet, and as the supply of water is scarce, great care is taken by careful jointing and caulking to prevent all leakage.

The curves are very wide, so that scantlings 28 feet in length are said to be exported with ease. This slide has been at work for 8 or 10 years, and is said to be a financial success to its present owners, but a former Company by whom it was built failed.

About 1 P.M. we arrived at White Sulphur Springs Hotel, 23 miles from the railway, where after vainly endeavouring to get rid of the dust which had rendered some of the travellers hardly recognisable, we indulged in luncheon, and then started about 3 P.M. for Clark's ranche, situated 12 miles further up the mountain, but which, owing to the hilly nature of the road, we did not reach till 6 P.M.

En route we passed several clearings in the forest devoted to the cultivation of fruit, such as grapes, apples, pears and peaches, which industry is now a thriving one in California.

The grapes are made into wine, which is of a very fair description, and the other fruits are exported under the name of canned or tinned fruits, and have now obtained a wide reputation for cheapness and excellence of quality all over the world. The part of California where fruit gardens have been most successfully established is in the neighbourhood of San Louis Obispo, situated about 200 miles south of San Francisco.

In this vicinity, a few years ago, good land could be purchased at rates varying from £2 to £5 per acre, and many energetic men having a slight knowledge of fruit culture, who started 8 or 10 years ago with small capitals of say £500, are now said to be reaping handsome profits varying from £30 to £50 per acre.

Clark's "ranche," the meaning of which latter term is apparently station, consists of a clearing in the middle of the forest,

where an extensive hotel and other buildings have been established, this being the place from which the Mariposa grove of big trees can be most conveniently visited.

The next morning after considerable difficulty, a guide was found, who in consideration of a moderate gratuity of 2½ dollars, or about 10 shillings, agreed to accompany me on foot to and from the big trees, which trip necessitated a walk of about 12 miles.

Before recording my personal observations on the big trees of Mariposa, a few general remarks in accordance with the latest opinions of the best American authorities regarding these far-famed curiosities of nature, may not be out of place here. The aggregate area occupied by the *Wellingtonia*, or *Sequoia gigantea*, is supposed to be about 50 square miles, the region in which this species is principally found, and which appears to be its most congenial habitat, being comprised between the King and Kaweah rivers.

This tract of country is situated about 200 miles east of San Francisco in the Sierra Nevada range of mountains, which may be considered a branch of the Rockies. There are said to be only eight or nine patches of the real *Sequoia gigantea* scattered on this area, the altitude at which the species is found varying from 5,000 to 7,000 feet. The geological formation is generally granitic, the soil in the places where the big trees are found being deep, and in such places there is always a good supply of water in the form of springs or small streams.

The big trees were discovered in the year 1855, when the tales told of their gigantic dimensions seemed almost incredible, one of which is the well known "Yankee" story, *viz.*, that they were so high that "it took two men and a boy to see to the top of them." The traveller's tales regarding the height and dimensions of these trees have, however, now been considerably modified, and after careful measurement, it is found that the tallest tree is one in the Calavaras grove, which measures 325 feet, whereas one of the trees having the greatest girth at the base is probably the "Grizzly Giant," situated in the Mariposa grove, the girth of which is 92 feet, though another tree is said to exceed 100 feet. These dimensions are of course enormous, but it may be noted that they are exceeded by the *Eucalyptus Amygdalina* of Australia, which has been found to attain 480 feet in height, and in girth, by the Baobab tree (or *Adansonia digitata*) of Africa, which sometimes measures as much as 100 feet in circumference.

The *Sequoia gigantea* generally grows associated with the following species—Yellow pine (*Pinus ponderosa*), sugar pine (*Pinus Lambertiana*), white cedar (*Libocedrus decurrens*), white fir (*Picea grandis*). At first, it was thought that these trees must naturally belong to some remote geological era, and were probably contemporaries with the mammoths and mastedons, but

after a careful examination and counting of the annual rings on the sections of several felled trees by various eminent botanists, it has been clearly established that the greatest age of these giants does not exceed 1,500 years, which after all is probably not much more than that of some English yew trees.

The number of trees over 50 feet in girth in the different groves varies from 50 to 400 or 500, and besides these, there are numerous other trees of all sizes and ages.

It is also stated that, throughout the nine clumps of *Sequoia gigantea* there are numerous young "big trees," so that there is no reason to suppose that the species is dying out.

The thickness of the bark is remarkable, and some pieces observed by me exceeded 24 inches, whereas in a small museum attached to Clark's Hotel I saw a piece having a thickness of 36 inches.

As regards my personal observations on the trees of the Mariposa grove, which was visited by me on the 5th of June last, the following are the principal notes made on that occasion :—

After leaving Clark's Hotel, we marched through a fine forest of sugar and yellow pine, mixed with a large proportion of white cedar, as well as a considerable number of black oak (*Quercus nigra*).* The undergrowth consists of various shrubs, amongst which the dogwood (or *Cornus Nuttallii*) was most conspicuous, it being in full bloom at the time of my visit.

I noticed another most conspicuous plant, *viz.*, what appeared to be a kind of ground orchid about 2 feet high, the whole plant being of a bright red colour.

The geological formation of this part of the Sierra Nevada consists of whitish granite, and the soil appeared to be deep and of good quality. All these forests belong to the American Government, except where special grants have been made to squatters, and to Mining or Timber Companies. A nominal control only is exercised over the remainder, except where the big trees are situated, which areas are reserved under the name of public parks.

Traces of extensive forest conflagrations were everywhere observed, and in former years, these fires were lighted by the Indians in order to clear the undergrowth and thus facilitate 'shikar' operations, but at present the fires are generally said to be due to the carelessness of shepherds, immense flocks of sheep from the plains of California being driven up during the hot weather to browse in these hill forests. After proceeding for about 4 miles through the forest, the slopes of which are gentle, the mean gradient being about 25 degrees, we struck the carriage trail about a mile from the big trees. The big trees of the Mariposa groves, the total number of which over 30 feet in girth is about 50, and situated in two groups called the upper

* Probably *Quercus agrifolia* or *Douglasii*.—[ED].

and the lower groves, the altitude varying from 6,000 to 6,500 feet. The area containing the big trees, the extent of which is stated to be about 2 square miles, is reserved under the name of a public park, and is in charge of a Board of Commissioners, which body appears to be a kind of local committee.

A set of rules prohibiting felling, firing, injuring, &c., have been drawn up, the penalty attached being 500 dollars and six months' imprisonment, or both. Nothing is said about sheep grazing, nor could I find any traces of demarcation, so that the arrangements are not very complete at present. These groves occupy what may be called the bottom and lower slopes of a series of small valleys, having generally a northern aspect, and are well sheltered by the surrounding hills and thick forests from all winds and tempests.

The soil is deep and consists of decomposed white granite and quartzite with a thick layer of vegetable mould. On approaching the groves from Clark's, the first trees encountered are the "Sentinels," then the "Three Graces," afterwards the "Grizzly Giant," all the principal trees having special names, which are written up in large letters.

Notwithstanding the fact that, the big trees are surrounded by yellow and sugar pines of an average height of about 200 feet which naturally hide them, still their appearance is most imposing, and they can fairly be compared to towers or to church steeples.

The tree having the greatest circumference in this grove is the "Grizzly Giant" above referred to, which at the base I found to be 92 feet in girth, but the height does not exceed 230 feet, the top having been apparently broken off by the wind. This tree is much injured by fire, and the base has probably flanged out in consequence, so that the original girth at the ground probably did not exceed 70 feet.

Various other trees I found to be of almost equal dimensions, notably the "Faithful Couple," or double tree, and apparently sound, which measures 90 feet at the base, also one of two trees called the "Twins," in the hollow inside of which, 17 persons on horseback can be accommodated.

The tallest and soundest trees I observed growing in a small well watered valley, just below the forest ground or custodian's hut.

Here the trees are straight and well grown, and the stems sometimes run up to 120 feet without a single branch.

Another remarkable tree is one situated highest up of all, and through which an archway about 18 feet wide has been cut. The forest driving track is led through this opening, and all tourists visiting the big trees of course specially note this as one of the most interesting sights, and the picture of this tree figures in a prominent manner in all the American advertisements. Throughout these groves I hardly noticed a single tree which was not more or less injured by fire, and I am certain that it is

only due to the great thickness of the bark of the *Sequoia gigantea* that a great deal more damage has not been done.

Nevertheless many trees have doubtless perished from this cause, and numerous half burnt trees and stumps are to be found scattered throughout the groves, and one tree which still remains standing, called the telescope tree, has its inside completely burnt out up to about 90 feet, and the top having been broken off, daylight is visible whilst looking up from below.

I observed comparatively little moss on these trees, which testifies to the dryness of the climate, the average rainfall being, as far as I could ascertain, about 25 or 30 inches only. Mr. Cunningham, the custodian of these groves, has lived for many years in this neighbourhood, and inhabited the Yosemite valley long before the advent of tourists. He amused us with many entertaining and romantic tales of the Indian inhabitants, and their doings in the good old times.

At his hut we purchased various curios, such as pieces of wood, bark, &c., and then retraced our steps by a different route to Clark's ranche, after a very pleasant day spent amongst the big trees of Mariposa. The next morning, we started in a car drawn by six horses for the far famed Yosemite valley, the distance from Clark's ranche being 25 miles.

The drive over a somewhat rough road was through the same kind of forest as those already described, traces of conflagrations being everywhere visible.

These forests are not, however, regularly burnt like those in some parts of the Himalaya, for which reason, certain portions probably escape for a number of years, and in such places I noticed a considerable number of seedlings, principally of the white cedar, springing up. On reaching what is called "Inspiration point," situated about 18 miles from Clark's ranche and 7 from the Yosemite valley hotels, the first glimpse of this famous valley is obtained, some idea of the grandeur of which may be gathered from a description given in one of the guide books, a quotation from which I shall give here. "The fame of the Yosemite has become world wide. Its towering cliffs, waterfalls like cataracts from the clouds, and the gigantic vegetation surrounding it have no comparison in the world.

"In sublimity of character and enchanting beauty it surpasses expression, and must be viewed to be appreciated.

"Several eminent writers have attempted descriptions, but all have despaired in giving the awe-inspiring feeling which fill the beholder of the mighty chasm."

The Yosemite valley, the meaning of which is the valley of the grizzly bear, is situated at about 4,000 feet above sea level, and various theories exist with regard to its peculiar physical formation. The average height of the surrounding Sierra Nevada range of mountains varies from 8,000 to 10,000 feet, and the most probable theory is that at the time of their upheaval the

Yosemite portion collapsed, as the peculiar form and extremely steep sides cannot be accounted for in any other satisfactory manner. The geological formation is the usual white granite of the Sierra Nevada, and a lake probably occupied the bottom of the valley at one time, which gradually became drained leaving the Merced river meandering throughout its length.

The Yosemite valley is about 6 miles long with an average breadth of one-third to one mile, and along the bottom the Merced river flows in a picturesque and placid manner, forming small lakes and pools all along its course, the borders being shaded by groves of various kinds of trees.

The valley is surrounded on all sides by gigantic cliffs and precipices, the principal of which are El Capitan, which presents an almost perpendicular face of 3,000 feet, the Cathedral spires, the North Drome, the Sentinel rock, &c., all of which tower from 3,000 to 4,000 feet above the valley.

From various points all round this peculiar ravine numerous waterfalls, fed by the melting snows of the Sierra Nevada, pour down their waters to join the Merced river, there being in all eight main falls and as many smaller ones.

The principal waterfall is the "Bridal veil" fall, which is first seen in entering the valley, the vertical height of which is 940 feet, and a fine view of which is obtained as soon as Inspiration point is reached.

The next most striking cascade on the left hand side of the valley is the Yosemite fall, close to which the hotels are situated, and which descends 2,600 feet in three successive falls, the perpendicular height of one of which is 1,600 feet.

At the head of the valley, the Nevada fall is the most striking, the vertical height of it being 700 feet, and the volume of water probably 60 feet wide, and 10 feet deep. The quantity of water in the other falls referred to is somewhat less than this, but in most of them, owing to their great height, even vaster bodies of water are dashed into spray before they reach the basin below. The Yosemite fall is by far the finest in the valley, and the thunder of its waters may be heard from a distance of several miles.

The best season to see the waterfalls of the Yosemite, in their full beauty, is from the 15th of April to the 15th of June, at which time the melting of the snow takes place. There are three good hotels in the valley for the accommodation of the numerous travellers, and besides these, there are a limited number of private houses, most of which were built before the valley was constituted a public park or reserve, but the building of new houses is now prohibited.

In addition to the American population, which probably does not exceed 200 permanent residents, there are a few Red Indians, who are generally employed as farm servants, but a few of them cultivate small farms.

The vegetation of the Yosemite consists principally of the yellow and sugar pine, together with a fair proportion of the bastard cedar.

Various other species, such as maples, alders and oaks are common, but the *Sequoia gigantea* or mammoth pine does not exist in an indigenous state. The undergrowth consists principally of azalias, various kinds of cornus, barberries, ferns, &c. The climate of the Yosemite valley is subject to considerable variations of temperature, and during the winter, the waterfalls are sometimes frozen, and snow lies to a depth of 2 or 3 feet for several months. During the summer, the temperature is hot and close, and at the time of my visit, the thermometer stood at 85 degrees in the shade.

The following are the principal animals found in the neighbouring Sierra Nevada mountains, grizzly bears, which sometimes attain considerable size, the skin of one seen at Clark's Hotel measuring 8 × 9 feet, and the brown and cinnamon bears, which are smaller animals, and probably about the size of the Himalayan black and brown bears.

These animals are by no means common now, nor is the Puma or mountain lion which is now nearly extinct.

Wild dogs, foxes and skunks are still fairly common, but wild pigs are now rarely met with, in this part of California. The American elk, the moose, and a species of *Ovis Ammon* have now almost disappeared, but are still to be found towards the north, in Montana and other of the northern States. The wild bison has disappeared from this part of America, and is now only found in Mexico, Texas, Wyoming and Montana.

A fine driving road traverses the Yosemite valley on both sides of the Merced river, besides which, there are numerous footpaths leading to the waterfalls and to most of the surrounding accessible peaks.

One of the most interesting excursions is to what is called the Glacier Point and Sentinel Dome, situated 3,000 and 4,000 feet respectively above the valley, and from which a magnificent view of the valley and surrounding mountains can be obtained.

The walk from the hotel, a distance of about 8 miles, is a pretty stiff one for those unaccustomed to mountain climbing, so that nearly every one rides.

The Glacier Point is a projecting rock which overlooks the valley, and from which a stone may almost be dropped for about 3,000 feet without touching the face of the precipice.

The view from the Sentinel Dome, situated about a mile further up the hill, is grand and imposing, most of the waterfalls being visible, and a magnificent panorama presents itself of the Yosemite valley and surrounding peaks of the Sierra Nevada mountain, many of which were capped with snow, the intervening valleys being thickly clothed with pine forests.

As regards my personal opportunities for comparing the scenery of the Yosemite valley with that of other mountains, I may observe that I have seen as fine individual cliffs elsewhere, especially in the Himalaya, but nowhere probably is it possible to find such a collection of stupendous peaks, precipices and magnificent waterfalls all concentrated into a limited area of about 6 square miles.

E. McA. M.

THREE DESCRIPTIONS OF THE STATE FOREST OF TRONCAIS (ALLIER).*

THE State Forest of Tronçais, in the north of the Department of the Allier, contains an area of about 26,250 acres, or 41 square miles of High Forest. If we add to it the forest of Civrais, only a few hundred yards distant, the entire wooded area comprises close upon 30,000 acres, or 47 square miles; a magnificent property.

Tronçais contains about 3,000 acres of old high forest, where a great number of fine old oaks, aged from 150 to 225 years, are still standing, reckoned amongst the finest oaks in France, and yields the best class of staves.

The revenue of this forest in 1885, amounted to 4,45,000 francs (Rs. 1,78,000), about 18 francs (Rs. 7·2) per acre, a fairly good figure in these days, when it is the fashion to say that, our department gets no return from the State forests, forests give no revenue, and it would be better to convert them into arable or pasture land. We know several agricultural proprietors, who farm their lands most carefully, and yet obtain less than 8 or 12 francs per acre. They would look upon 18 francs an acre, as an altogether unhoped for result.

It is well worth while becoming acquainted with this fine forest, and considering whether its management by the State Forest Department has not been attended with the very best results.

Official luck has given me the charge of the forest of Tronçais, and I have been obliged to look up some of the old papers relating to its former condition. Indeed, to speak fairly, these papers were handed over to me by the distinguished Conservator at the head of the 21st Circle, who will not contradict my assertion that he loves forests, and particularly the forest of Tronçais. The only trouble I have taken has, therefore, been to read and to copy.

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* Translated from a paper by M. Desjobert in the "Revue des Eaux et Forêts, 10th November, 1886."

For it is merely the three descriptions of the forest of Tronçais, of 1670, 1832, another made partly in 1868, and partly in 1883, which will be given.

Let me add that the figures, which I give, are not more accurate than the matter requires; and are only intended to show the relative importance of the different standing crops.

The description of 1670.

This is by Florimond Huart, Chevalier, Seigneur of St. Denis, Privy Councillor, and President of a Commission of enquiry into the forests of France in the provinces of Orleans, Blois, Tours, Poitiers, Bourges and Moulins, and by Jean Leféron, Privy Councillor and Commissioner for improving the above mentioned forests.

The Tronçais forest contains in one block, 18,600 arpents, with 2,000 arpents adjoining. It is situated on a soil fit to bear high forest up to the age of 200 years, as we have ascertained, both by an examination of the soil and of the fine oak trees *in situ*.

The greater part of the area is stocked with old oaks of 150, 200, and 300 years, for the most part branchy, stag-headed and dying, relics of former fellings standing in compartments entirely ruined, without a single seedling or coppice shoot; the balance of the area, however, is well stocked with mature oak forest.

Then follows the description of the compartments, but we have thought it better for comparison to give these in smaller type, alongside their later descriptions in 1832, 1868 and 1883.

Description of 1832.

This is by M. de Buffévent, and is followed by a highly interesting report by M. Lorentz, after which a royal decree of the 24th April, 1835, decided that the central part of the forest (section B of 9,250 acres) together with 850 acres of the Garde de La Bontielle, should be regenerated in 60 years.

All the remainder of the forest was placed under preparatory treatment with a view to its future management under the system of high forest with thinnings.

At the same time, it was ordered that all the blanks should be re-stocked with conifers.

From M. de Buffévent's description of the compartments, we gather that section B, comprising 9,250 acres, was then composed of a high forest of oak and beech, with stag-headed hornbeams.

The crop was here and there, throughout the area, interrupted by very damp blanks covered with broom, gorse and heather, but the reserved trees were very fine and aged about 200

to 300 years, while the beech from seed were extremely fine, those from coppice shoots being on the decline.

The rest of the area consists of 8,460 acres of stored coppice of beech and oak, of 2,660 acres of blanks resembling those in section B, and of 6,700 acres of high oak and beech forest, in which the beech was dominating.

Description of 1868 and 1883.

We find two recent descriptions of the forest, the one made in 1868, by the 7th Working-plan Commission, consisting of MM. Soumain, Buffault, Bernard and Marbaret; the other only applying to areas where the estimated yield (*possibility*) of the forest was being revised, and dated May 1883, drawn up by M. Fabre, under M. Galmiche's orders.

This last description has been adopted, wherever it exists, and in default, that of 1868.

The new compartments have been included in the old ones of 1670, in order to allow for comparison, and the descriptions have been greatly curtailed.

The conclusions drawn by the Commissioners of 1670 were as follows:—

1. To reserve the 300 arpents of high forest.
2. Coppice in 33 years at the rate of 50 arpents a year the 1,660 arpents of old dying oaks.
3. Cut back the 16,340 arpents of old ruined fellings, where nothing remained but a few sapling oaks, and other trees spared by the wood merchants, under which in some compartments some hornbeam and a few seedling oaks existed. Ten of the best saplings were to be reserved per arpent.

These improvement fellings were to cover 80 years at the rate of 200 arpents a year, and to replace the ordinary sales of standing crop.

After 80 years of these fellings, the high forest system was to be re-introduced with a rotation of 90 years, at the rate of 90 arpents per annum.

Acorns were to be dibbled in amongst the heather and in the blanks.

All pasturage was to be excluded, and the forest surrounded by a ditch 8 feet broad by 6 in depth.

We have already given the prescriptions which resulted from M. de Buffévent's inspection, and by Government orders of the 17th April, 1869, the forest was subdivided into six high forest working circles, with rotations of 180 or 144 years, and this plan is now being followed.

The present forest staff consider that it would be advantageous to take 180 or even 200 years for the rotation of the six working circles.

Comparative Description of Compartments.

Name of Compartment.	Area.	1670.	Area.	1832.	Area.	1868 or 1883.
	Arpents.		Acres.		Acres.	
Bois Chavereau, ..	115 173	Fine oak high forest of 100 to 150 years. Old ruined coupes to be cut back.	250 100	Stored coppice. Beech predominating; coop here and there incomplete. Seedlings fairly numerous. The standards are too scattered, and are mostly crooked, stag-headed and unsound. Blanks covered with heather, gorse, juniper and broom, containing here and there a few coppice clumps and dying trees.	350	No blanks. 85 acres of fine Scotch pine; 40 years old. The remainder, oak and beech poles partly coppice shoots, in full vigour of growth; 100 years old.
Garde de l'Armenauche,	2,960	The greater part of the area badly stocked with old oaks of 150, 200, and 300 years, mostly stag-headed and dying, the relics of former fellings.	2,325	Stored coppice, having the beech, generally from seed, as the predominant tree. The ages are irregular, comprising old trees on the decline and nearly	1,250	Poles of mixed species, oak and beech dominating, half old coppice shoots, rather scantily stocked. Growth middling. Age 90 years.

Name of Compartment.	Area.	1670.	Area.	1832.	Area.	1868 or 1883.
	Arpents.		Acres.		Acres.	
Garde de l'Armenauche, (*continued*).		The stock is ruined by cattle and sheep grazing, and by the forest being fired annually for fresh herbage. Forest offences have been allowed with impunity; 300 arpents, of which half has been cut over in the last 15 years, is entirely ruined and without a single coppice shoot. The crop should be cut back, all except the most promising trees, which will serve as standards for the regeneration of the compartment. Acorns must be dibbled in where necessary. There is at the Blancs Fossées a fine young		all stag-headed; saplings from seed, younger than the surrounding coppice shoots; so that the crop resembles that of a forest treated by *jardinage*.	1,250	Poles of oak and beech; crop regular, dense and promising; 90 years.
				The crop is also here and there interrupted by glades.	500 70	Fine pine poles; 40 years. Blanks.
			375	Deplorable condition, the soil entirely covered with a dense growth of heather, holly, junipers and gorse. A few old trees and some coppice clumps exist here and there.		
			375	Coppice and isolated seedlings under a few very scattered trees.		
				The crop is everywhere interrupted by blanks with heather, broom, holly and junipers, a few seed-		

		high forest of oaks of 100 years, which should be set aside for principal fellings and for the Naval service.		ling trees here and there. The reserves are very poor, and those felled in the last coupe have sent up shoots forming clumps measuring 4 to 7 metres in diameter.		
Garde de la Goutte Ardent.	1,500	Badly stocked with old deformed and stag-headed oaks of 200 to 300 years, with some beech of 50 to 100 years, under which we find hornbeam, birch and other soft woods. It is ruined by constant cattle and sheep grazing, by forest fires, and by the non-production of shoots after the fellings.	1,000	Young coppice, principally of beech. The standards are young and vigorous, and the crop promising.	650	Fine regular complete and dense crop of oak and beech poles, partly on stools, 70 years old; very promising; a few old reserves.
			625	Same as No. 2 of l'Armenauche.	537	Old coppice shoots, surmounted by numerous standards of 160 years, with vigorous young poles from seed, and some old standards.
			375	Same as No. 3 of l'Armenauche.	575	Scantily stocked with poles, half grown stools, oak and beech, the former predominating, middling growth; 75 years; with a mingling of splendid patches of Scotch

Name of Compartment.	Area.	1670.	Area.	1832.	Area.	1868 or 1883.
	Arpents.		Acres.		Acres.	
Garde de la Goutte Ardent—(*continued*).						pine from 10 to 40 years old, which cover about half the area.
					150	Blanks.
Garde du Meslier, de la Jarry et de Morat,	7,430	Covered with old ruined coupes. The crop has been destroyed by cattle and sheep grazing and forest fires. A few dying oak poles remain, which have been repeatedly burned.		This garde with that of Jarry and Morat form M. de Buffévent's section B.	833	Complete and promising seedling crop of oak and beech, 40 years old, with about 50 acres of blanks and glades.
			9,250	High forest of oaks, mixed with beech and stag-headed hornbeam. The crop is everywhere interrupted by very damp blanks and glades covered with broom, gorse and heather.	550	Poles 30 to 40 years; mixed crop very promising on half the area; very slow growth on a fourth of it. 37 acres of fine young pine seedlings, and as much blank.
				Holly is common in the wooded parts. Patches of seedlings occur in the heather, generally incompletely stocked. Most of the beech are coppice shoots, and are	650	Seedling crop of 25 years, complete and promising, except in the hollows, where the young seedling crop, though complete, has suffered severely from spring frosts; 20 acres

			dying out, those from seed, on the contrary, are very fine trees.		of blanks sown up with pine.
			The standards on the last coupes are about 200 to 300 years old and very fine trees.	312	Complete well-grown crop of 40 years from seed; oak, beech and hornbeam.
			About 150 acres are to be re-stocked by the proprietor of the smelting furnaces of Tronçais, Le Sieur Rambourg, in exchange for forest produce.	190	Old oak high forest, under regeneration. Nine-tenths of the area covered with fine young seedling crop of mixed species, the oak predominating. One-third of the old trees are on the decline.
			The sowings have only succeeded on half the area, the remainder being covered with impenetrable heather.	62	Blanks.
				1,770	Old high forest of 180 years of the following types:— (*a*). Dense, regular, lofty high forest of pure oak; undergrowth scanty, but abundant where sheep grazing is excluded, and almost entirely wanting where it is allowed. (*b*). Regular high forest, forming a dense lofty crop, generally complete, but scanty here

Name of Compartment.	Area.	1670.	Area.	1832.	Area.	1868 or 1883.
Garde du Meslier, de la Jarry et de Morat—(*continued.*)	Arpents.		Acres.		Acres.	and there, over an undergrowth of beech and hornbeam in thicket, or poles from 20 to 30 years old. Thanks to the undergrowth, the high forest is still in fine condition, and shows no signs of deterioration. The phrase "*fine growth, very fine oaks*" constantly recurs in the description. For about one-tenth of the area we read: damp blank of so many acres, where the oaks are branchy and unpromising.
					1,375	Regeneration seed coupes generally described, as follows:— "Old scantily stocked high forest regularised by seed

						fellings, the standards branchy and not being sufficiently numerous to ensure reproduction." We may add that the exceptional acorn year of 1884 has since produced an abundant crop of seedlings everywhere.
						Blanks very rare.
					175	The results of le Sieur Rambourg's sowings. Pure complete regular oak poles, very promising. Beech has been planted as an undergrowth.
					3,250	Seedling crop 10 to 40 years old, complete, and very promising, thickets and poles, oak predominating. About 250 acres subject to attacks of spring frosts.
					75	Blanks.
Garde des Landes Blanches.	2,430	One-fourth of the area near Morat has been exploited in ruined coupes, which have	650	On most of the area, oak coppice from 3 to 20 years old, interrupted here and there by blanks	425	Fine pine poles; complete crop, with an undergrowth of mixed broad-leaved species. 45 years.

Name of Compartment.	Area	1670.	Area.	1832.	Area.	1868 or 1883.
	Arpents.		Acres.		Acres.	
Garde des Landes Blanches—(*continued*).		been grazed down and injured by fire, with old dying and burned oaks, birch, hornbeam, aspen and other soft woods. The remainder near Pizégu, badly stocked with old oaks of 100, 200 and 300 years, dying and burned, under which are numerous hornbeam, and a few oaks and beech.		owing to the stools being too old to coppice. The remainder; blanks and oak high forest very scantily stocked and on the decline. The soil is everywhere infested with undergrowth of injurious plants. Here and there we find a few planted or sown oaks Stag-headed reserves here and there, over the coppice.	1,975	Mixed poles, very promising on $\frac{4}{5}$ths of the area, and rather scanty on $\frac{1}{10}$th, the remainder very scantily stocked. About $\frac{1}{10}$th coppice. 45 to 75 years old. Everywhere in the description, we read "Fine straight poles, complete and promising crop."
		About 200 arpents grown in the best places have been exploited and jhumed and are now ruined by fires and grazing. The crop must be cut back, and the better trees reserved as standards, and acorns dibbled in the blanks.	560	The forest destroyed, for only a few scattered trees and patches of seedlings remain. The soil is covered with heather and gorse. The greater part is allotted as a temporary privilege for pasturing the cattle of the furnaces of Tronçais.	437 325 125	Old stored coppice of oak and beech with hornbeam on stools. Fine growth 65 years old. Plantations of different ages, generally promising. Glades.

			2,075	High forest fairly promising, over coppice shoots. The oak predominates, and is vigourous and generally from seed.		
			725	Same description as No. I. of Landes Blanches.		
Garde of Pizégu, ...	1,300	Old coupes entirely ruined, grazed down and partly burned. A few dying oaks from 200 to 300 years old remain, under which there are only a few birch and soft woods. Cut back, reserve the best trees, and dibble in acorns in the blanks.	275	Patches of oak seedlings, coppice shoots of the same species in clumps 5 to 9 metres in diameter with scattered trees. The soil is for the most part covered with heather, gorse, and brambles.	775	Irregular poles formed by old clumps, each bearing four or five poles, and surmounted by a few old standards, from 150 to 200 years old. About ⅕th of the crop from seed. Cover nearly complete, and crop promising except in the blank hollows. 85 years old. (Most of the old standards have disappeared in the thinnings).
			750	Oak coppice mixed with soft woods, the whole scantily stocked, seedlings are scattered in the blanks, and the reserves generally stag-headed.	875	Scotch pine, oaks and some soft woods. 35 years. Fine promising young poles, the three kinds being generally mixed.
					100	Glades.

Name of Compartment.	Area.	1670.	Area.	1832.	Area.	1868 or 1883.
	Arpents.		Acres.		Acres.	
Garde de Montaloyer,	1,500	Same as above.	1,850	Same as first two of Pizégu.	700	Dense vigorous poles of Scotch pine with a few oak coppice shoots. An undergrowth of planted oaks and beech generally successful. 35 years.
					450	Old, and more or less open coppice of 70 years.
					275	Very complete plantation of oaks and pine. 5 to 20 years old.
					225	Fine, dense, vigorous poles from seeds, 60 to 70 years old.
					200	Blanks and glades.
Garde de la Bouteille,	3,300	The greater portion ruined, grazed and burned coupes of various ages.	1,350	Beech coppice, the clumps very scattered. Heather, holly and other hurtful plants are very abundant.	450	Fine well stocked pine poles, with a scattering of broad-leaved species. 35 years.
		A few dying oak standards remain, under which we find a few oaks, beech and hornbeam from 50 to 100 years old.	175	Coppice full of standards, from which natural reproduction may be expected.	1,300	Old stored coppice dense, straight poles generally from seed. The coppice shoots are nearly all from hornbeam. Very promising. 75 years old.
			1,125	High forest with beech predominating. The		

	We must cut back, preserve the best standards and dibble in acorns in the blanks. About 300 arpents young promising high forest of oak and beech to be preserved. for ordinary coupes.		cover is very incomplete and interrupted here and there, by small glades. Holly covers the soil in certain places. Old gnarled hornbeam here and there.	875 Fine oak and beech poles 80 years old, nearly all from seed and mixed with hornbeam coppice; the crop is complete and very promising.
		125	Stag-headed oaks, hornbeam and birch; beech here and there on a soil covered by gorse, heather and juniper.	1,700 Fine young complete and promising thicket, chiefly from seed, with some hornbeam coppice shoots.
		600	Blank covered with heather; a few scattered trees and coppice shoots.	175 Blanks and glades.
		1,125	Oak coppice 17 to 27 years old, seedlings fairly numerous and a few patches of planted oak. Standards few and far between.	
			The Canton Du Bouchant, about 220 acres, is completely stocked with natural seedlings, the felling having taken place in a good acorn year. In this Canton there is a Roman fort.	

Those of our readers who have followed the descriptions given above, will readily perceive the immense improvement, which has taken place. It is indeed certain that, the Tronçais forest at present contains a crop, which although a little too young, will afford almost inexhaustible resources for the future. This accumulation of produce is due to the wise foresight of our predecessors. Let us act as they have done, and a day will come when Tronçais will produce, not 18 francs (Rs. 7·2) but 80 francs (Rs. 32) an acre. The calculation is simple enough. Places, not uncommon in Tronçais, could be pointed out worth 16,000 francs (Rs. 6,400) per acre. When the forest becomes thoroughly stocked and the ages properly graded, we ought to fell 125 acres per annum, representing 2 million francs (Rs. 8,00,000) for a forest of 25,000 acres, or 80 francs (Rs. 32) per acre. This is no exaggeration, for, if on the one hand, every acre is neither now, and never will be worth 16,000 francs, on the other hand, we have not included the value of the thinnings, which produce almost as much as the principal fellings.

How long it will take for such a result to happen we cannot say, perhaps a century. But what a complete success it is, to have transformed the almost blank area, which the description of 1670 reveals, into the magnificent forest, almost without blanks, which appears in that of 1869. It is certain that, the revenue of the forest will continue to increase slowly but surely. For this, only one point is essential; we must follow the lines of the present working plan, modifying it in a few details, if necessary, but never abrogating it. A working plan requires time to show its value. The present one has already lasted 20 years, and has done excellent work in regularising the standing crops. After 60 years, its good results will be still more evident.

M. de Buffévent, the eminent Forester whose descriptions we have perhaps curtailed too much, deserves the honor of having, so to speak, created the Tronçais forest. He laid down the main lines of the working plan, and his successors, though modifying them to a certain extent, have only followed in his steps: to make the old wood last as long as possible: to improve the standing crops so that when the old wood has disappeared, they may yield produce, if not equivalent in quality, at any rate in greater quantity: finally, to fill in all the blanks with conifers. As a result, we find at present, 3,000 acres of old high forest, which will last another 60 years: 3,750 acres of young high forest forming blocks of the third period, which in 50 years, will yield wood 150 years old, a little young perhaps, but quite marketable and able to yield fine timber: together with 5,000 acres of conifers, which are becoming re-stocked almost spontaneously with broad-leaved species, especially oak, under the protecting and fertilizing cover of the pines.

These 5,000 acres of conifers are a conquest over the waste, a conquest which has for some time been productive, for many of the plantations are 30 to 40 years old, and in them the thinnings every 7 or 8 years often produce an annual average revenue of 12 francs (Rs. 4·8) per acre.

This simple and productive idea of filling up the blanks by planting has been steadily carried out since it was prescribed by M. de Buffévent. Every year, the insufficiently stocked coupes are completed, by sowing or planting oaks and beech, and the blanks and glades in the thinnings are re-stocked with conifers. In 1887, this operation will extend over 75 acres. It is clear that in 15 years there will not be a blank in the forest.

M. de Buffévent found the forest either covered with mere herbage, or with impenetrable thickets; the boundaries scarcely fixed, a complete absence of roads, the forest guards living in the neighbouring villages, or in some miserable huts not deserving the name of forest houses.

There are now 20 forest houses, one being sufficiently large and comfortable for the officer in charge of the forest, his family and his friends, among whom we include the inspecting officers, and those foresters, only too few alas! who may wish from time to time to visit and admire the wealth of the Tronçais forest. In this forest, where export roads were formerly unknown, where the trees were dying as they stood, for want of purchasers, we now find 20 miles of ordinary forest roads and 24 miles of metalled ones fit for a carriage and pair.

The facility of export gives a value to a mere bundle of heather, to a heap of chips, and allows the hurried visitor in a two days' tour to form a sufficiently good idea of the forest.

More than 78 miles of boundary ditches have been dug, fixing absolutely the boundaries of the forest, and preventing the slightest encroachment: only 5 or 6 miles remain to be done.

We give the following abstract of M. de Buffévent's description, and of the actual state of the forest:—

State of the Forest in 1832.

	Acres.
Fairly well stocked woods, ...	11,250
Woods ruined by grazing, ...	10,000
Blanks, ...	5,000

Actual state of the Forest.

	Acres.
Well stocked woods, ...	22,500
Unpromising „	2,250
Glades or blanks, ...	1,500

A mere glance shows what has been done.

FENCING OF RESERVES IN JEYPORE.

In reply to "A. J. C.'s" remarks in your October Number regarding fencing of reserves in the Jeypore State, I beg in the first place to observe that the few remarks made in my report on the subject were only intended for the use of the local officials, who are of course well aware how such fences are constructed, and it is perhaps needless to say that the paragraph was not intended for circulation.

However, as "A. J. C." seems to be of an enquiring turn of mind, I have much pleasure in replying to his questions as follows:—

1st. The cost of coolie labour at Jeypore varies from 3 annas to 4 annas per day.

2nd. The nature of the country where it is proposed to construct fences is generally flat or slightly undulating.

3rd. The soil of the Jeypore State consists mainly of sand with a certain percentage of clay and lime.

4th. The object of the ditch and embankment is to keep out all kinds of cattle, the country being overrun with them, so that without a fence of some sort, protection of the reserves situated in the plains at all events is next to impossible.

5th. Forest operations in the Jeypore State being in their infancy, little fencing from a forest point of view has yet been done, so that reference was principally made to the fencing of fields, gardens and compounds by the villagers, engineers and residents.

The total length of such fences throughout the State probably amounts to several thousand miles, but this is of course merely a guess.

6th. These kind of fences are fairly effective, otherwise they would not be in such general use in this part of Rajputana.

7th. The climate being a dry one, the cost of repairs is trifling, and probably does not exceed Rs. 25 per mile per annum, but in the case of an exceptionally heavy rainfall, which is rare, these kind of fences are of course liable to be swept away.

The planting of Pani grass (*Saccharum sara*) on the top of the embankments, where it readily takes root, has a wonderful effect in protecting them from the effects of the weather.

E. McA. M.

STUDENTS FROM THE N.-W. PROVINCES AT THE FOREST SCHOOL.

With reference to the statement on page 521 of the November Number of the "Indian Forester," in the review of the N.-W. Provinces and Oudh Forest Report for 1884-85, the writer

states that, he is under the impression that the Forest Circles of the N.-W. Provinces and Oudh have been rather backward in utilizing the Forest School.

This is to a certain extent true, as regards Oudh, but in the Central Circle, during the last few years, 6 men have been appointed as Ranger probationers, and 12, as Forester probationers. Of the former, no one has as yet passed through a complete course at the Forest School, though one will probably obtain the Rangers' certificate, next March. The other five men resigned their appointments, except one, who failed to qualify.

This shows that service in the N.-W. Terai forests is not popular amongst educated natives, who have much pleasanter and better paid posts available in other Departments, or may become vakils.

Of the Forester probationers, two have obtained the Foresters' certificate, and four are still studying at the School in the Vernacular Class.

The School Circle has largely benefitted by the instruction afforded at Dehra, and two probationers have obtained the Ranger's certificate with honors, a distinction hitherto confined to only one or two men in each year. Besides these, another candidate from the Circle has obtained the ordinary Rangers' certificate, and six others the Foresters' certificate, whilst four are still at the School. The reason why the N.-W. Provinces Circles did not, at first, use the School more freely was owing to the want of graded Rangerships, but as liberal establishments have now been sanctioned by the Government of India, this difficulty has disappeared, and at the time referred to by our reviewer, there were 16 men from the province at the Dehra Dun Forest School, out of a total of 67 students from all parts of India.

LISTS OF FOREST OFFICERS.

Now that there is an Imperial Forest School for training Sub-Assistant Conservators and Rangers, it would be very useful, if the half-yearly list of Forest Officers under the Government of India were to include those in Madras and Bombay as well. Men trained together at Dehra could then readily follow the transfers and promotions of their old friends.

At present, the Bombay list is not prepared like that of India and Madras, and entirely omits all mention of Rangers. Neither does it give the charges of the officers concerned, but is a mere monthly gradation list. Surely the book of India and Madras models could be followed in Bombay, and if the three lists were combined and issued to every Forest office in India, it would be thoroughly appreciated.

Eventually the principal Native States, which also get their

Forest Officers trained at Dehra Dún, could send the necessary information to the Inspector General of Forests, and their officers might also be included in the list, which would then be complete for the whole Forest Service of India.

PRESERVATION OF INDIA RUBBER TUBING.

THREE years ago I found myself supplied with more India rubber tubing than I required, and was afraid that the stock would soon deteriorate. To prevent this, I took 16 feet of $1\frac{1}{8}$ inch tubing and 16 feet of $\frac{3}{4}$-inch tubing and soldered it up air-tight in a tin box. I have now had occasion to open the box, and found that the India rubber tubes are most perfectly preserved. They had a strong rubber scent, and are as elastic as could be.

The colour of this rubber was originally, and is still, slightly reddish, not brown. If the above experiment proves that India rubber is preserved by air-tight soldering, it would be useful to publish the information, as I know that much loss is incurred in this country by the deterioration of exposed India rubber goods, medical apparatus of India rubber, &c.

H. WARTH.

FIRES IN FORESTS.

IN his Report on the forests of the Central Provinces (November 1885 to February 1886) the Inspector General notes that his observations led him to the belief that an occasional fire in a forest after some years of successful protection had a less harmful effect than annual fires. Most people believe that a fire in a forest that has been closed for a few years renders the state of that forest worse than the first. Would it not be a useful thing to invite the opinions of officers on this important point? I think the Inspector General's idea is true for *Pinus longifolia* forest, but then that is such an exceptionally hardy species as regards fire.

Q.

II. REVIEW.

FORESTRY IN THE PUNJAB.*

THE highest praise is given by the Government of India to this report, which affords a clear and graphic account of the progress of Forestry in the Punjab.

The actual report, exclusive of appendices, covers 35 pages, and we are very glad to see that the idea has been finally abandoned that, a forest report could be simply an explanation of the Comptroller General's and other forms prescribed by the Code, the Government of India admitting that the present report is as concise as circumstances would permit.

Forest reports are really of most use to Forest officers, and should, therefore, leave out no fact of general interest to the provincial administration, and it would be impossible to avoid this, if reports of important Circles were greatly curtailed.

We read in para. 4 of the introduction to the report, that the Financial Commissioner assumes the executive control of the Punjab forests, the duties of the Conservator being those of inspection, distribution of establishments, regulation of expenditure and giving advice all round. Under these circumstances, it is not quite clear why the report does not really emanate from the Financial Commissioner's office and in his name, instead of his merely receiving a proof copy from the Conservator, to enable him to send up any remarks he might wish to offer to Government with the report.

Considering that the Financial Commissioner is the executive chief of the Forest Department in the Punjab, it is a pity that his remarks on the work of the year have not been published.

It appears, however, that the Government of India are not altogether satisfied with the present position, as in their orders it is proposed that the Lieutenant-Governor should give his opinion in the next annual review "whether, or how far, the Financial Commissioner should exercise executive control over the forests in the several districts, beyond that implied in his approval of working-plans and annual plans of operations."

* Progress Report of Forest Administration in the Punjab for 1885-86, by H. C. Hill, Conservator of Forests, with review by the Lieut.-Governor and the orders of the Government of India.

Mr. Hill does not altogether concur in the benefits of the Financial Commissioner's executive control, for we read, in para. 64 of the report—

"By way of further alleviating the distress, the Financial Commissioner, when on tour in the district, made another concession, which was unfortunate in resulting in wholesale damage to the jhand trees in unreserved forests. He permitted for three months the removal of the tender shoots of jhand, provided *daranties* only and not hatchets were used. This too apparent a thin end of the wedge was promptly taken advantage of by the people, and they had no sooner been given the tender shoots, then they went to work with the usual herdsman's hook and axe, lopping off leading shoots and tearing down the brittle branches of all sizes. They went so far, in many instances, as to fell good average trees. No less than 180 prosecutions were instituted, but the mischief was done, and the time of permission had expired, before the destruction could in this way be checked."

As regards the position of District Forest officers in the Punjab, they are now the assistants of the Deputy Commissioners in all forest matters, and in some cases, having charges extending over two districts, several of the District Forest officers have two masters.

This is due to there being insufficient Forest officers in the Punjab, but cases of this kind could surely be met, as in Assam, by promotion of some of the deserving Forest subordinates to the grade of Sub-Assistant Conservator, and giving them the less important district charges.

Provided a Forest officer has complete control of his own establishments, and that the Deputy Commissioner gives no orders in the district in forest matters, except through the District Forest officer, we have no objection to the present system in the Punjab, except that the Conservator should be solely responsible to the Local Government for the executive charge of the forests, and we fail to perceive the utility of the intervention of the Financial Commissioner.

It is apparently due to a jealousy on the part of Civil officers, of the control of an officer belonging to a different branch of the service, but we do not suppose that in the Punjab, the Sanitary Commissioner, Secretaries in the Irrigation and Provincial Public Works Departments, or the Inspector General of Police, are other than the executive heads of their own Department, and we fail to see, why a different arrangement should be required for forest management.

Forest officers are equally the assistants of the Deputy Commissioners, in the Central Provinces, and in Assam, and yet in those Provinces, no necessity has arisen for depriving the Conservator of Forests of his executive control of any details of forest management.

To show how backward forest conservancy still is in the Pun-

jab, and how disinclined the Local Government is to entrust the management of its forest lands to the Forest Department, we give the following extract from the orders of the Government of India :—

"Excluding the area of reserved forests formed under the leases entered into with the Rajas of Chamba and Bashahr, the area of reserved forests amounted to 1,068 square miles at the end of the year. This shows that an increase has taken place in the area of reserves within British territory of 53 square miles during the period under review, and it is observed that the reservation of more extensive areas in the Rawalpindi and Kulu Districts may be expected to take place during the current year. This is satisfactory; but, nevertheless, His Excellency the Governor General in Council desires that Sir Charles Aitchison's attention may be drawn to the fact that the area of reserved forests in the Punjab comprises only 1 per cent. of the area of the Province, against 7·24 per cent. in the rest of the Bengal Presidency. At the same time, it is observed that some 20,000 square miles of forests and waste lands exist in the Punjab, which would seem to fall under the description of land which may be constituted reserved forest in Section 3 of the Indian Forest Act, and thus apparently to render possible a considerable addition to the reserved tracts. As yet, however, only 5·34 per cent. of these lands have been permanently settled under Chapter II. of the Forest Act, and 1·60 per cent. under Chapter IV.

"Under these circumstances, His Excellency the Governor General in Council regrets that His Honour the Lieutenant-Governor should concur in the view shown in paragraph 9 of the Conservator's Report to be held by the Financial Commissioner, which inclines to restrict the reserves to comparatively small areas. It seems to His Excellency the Governor General in Council that 'Forest and waste lands, such as those of the Muzaffargarh District, which have been declared at Settlement to be outside the requirements of the local population, and the Lahore rakhs, equally the property of Government free of all rights,' may be managed with most advantage after they have been demarcated and received a definite legal position as reserved or protected forests, and all rights over them have been settled. These Settlements, while they effectually define and protect the Government forest property, do not circumscribe the powers of the Local Government in the management of its forest estate or in the utilization of its produce."

Considerable progress has been made during the year in demarcation, and a statement is given, the report showing the progress in forest surveys and the areas which are still unmapped.

Working plans have been drawn up for the forests on the Upper Ravi, for the Changa Manga plantation, and for several other forests, and collection of data for some of the Pangi and Rawalpindi forests is in progress. We hope that some of the completed working plans may be circulated for general information to Forest officers in India.

As regards fire conservancy, we read that, 243 square miles

of reserves requiring special protection were preserved from fire at a cost of Rs. 901, or at 1·1 pies per acre. This very low rate shows the facility of fire-conservancy in most of the Punjab forests.

At the same time, the difficulty of protecting chir forests is apparent from the following extract :—

"The suggestion made in para. 8 of Government of India review of the Annual Report for 1884-85 in regard to Hazara was acted upon, and a fair trial was made by clearing of pine needles a line of 100 feet broad along 5½ miles of the boundary of the Batrasi reserve. The experiment was not a success, as the very heavy fall of *Pinus longifolia* needles which takes place in May and June, the precise time when fires chiefly occur, had the effect of re-covering the line in a few days to a sufficient extent to allow of fire crossing. The only way to prevent fires seems to be to prohibit wilful firing, and to force communities to at once turn out and extinguish accidental fires. The spread of a fire in these hills is in the beginning not very rapid, and when proper efforts are made, all are, as a rule, extinguished before any large area is burnt over."

Mr. Hill states that reserves other than those especially protected escape fire, but this statement is of a very general nature, as the following table of fires in forests and waste lands indicates :—

"The following statement of all fires reported in forests and waste lands, carries on the comparison with previous years :—

Division.	Number of fires.		Total area over which spread.		Remarks.
	1884-85.	1885-86.	1884-85.	1885-86.	
Hazara, ...	23	11	13,827	4,460	
Rawalpindi, ...	10	15	179	265	
Chamba, ...	11	7	...	35	
Kangra, ...	7	3	484	3	
Kulu, ...	26	67	448	3,019	
Bashahr, ...	13	9	Not given.	Not given.	The open area of Kalesar is not included : it is regularly burnt over.
Chenab, ...	2	*Nil.*	20	*Nil.*	
Lahore, ...	5	9	245	25	
Mooltan, ...	13	21	4,845	8,410	
Montgomery,	2	*Nil.*	7	*Nil.*	
Phillour, ...	3	3	2,000	500	
Total, ...	115	145	22,055	16,717	

As regards the management of forests intended chiefly for grazing, the following remarks by Mr. Hill are very much to the point :—

"By closing areas for the entire year and disposing of grass by sale, and by closing other areas for part of the year, and only opening them to a limited number of cattle, and for such time as is necessary for the consumption of the grass crop, fodder reserves of two classes are established, and these of themselves do all, that can be done, to tide over periods of scarcity within the year. When entire years of drought occur and further provision becomes necessary, hay can in good years be made and stored from the closed areas. The closing of areas is still considered a great hardship and objected to by the people with much persistency. It is worthy of note that, while a tract is held by Government, the withdrawal of it from the open grazing area is complained of as a measure carrying complete ruin to the population for miles round. The complaints are often supported, and the measure is looked on as an infringement of rights. In the event of this same tract being alienated by sale or grant, however, the people rarely murmur or affect to put forward any claim in regard to it. Again, it is found that earnest objections are urged against the closing of an area, though it may not afford any pasturage. Although there are doubtless times when the grazing is much needed, the people often petition to have tracts opened, not because they cannot do without the pasture, but merely to be freed from the restriction and the inconvenience consequent on the herds having to be tended, when near the closed area. So long as the lands are managed by Government, they refuse to respect the right and ownership of the property as they are compelled to do when it passes into the hands of private persons. Where the proprietorship is understood and respected as at Changa Manga, no difficulties are felt or complaints made; but cross the railway line into reserve Jalleki, and closing for part of the year only is urged to mean nothing short of ruin. Time and a firm policy will teach the people that State properties, unburdened by rights of user, may and ought to be managed to as much advantage as private lands. The closed areas once established and accepted, the people will doubtless appreciate the benefits of either a grass reserve from which they may cut at all seasons, or a certain good pasture land upon which they may fall back when the open lands are bare."

As regards protection from grazing, we read that 513 square miles of reserves are entirely closed, 330 square miles are open for a part of the year only to horned beasts, and 851 square miles open throughout the year, and the latter are closed against camels, goats and sheep, termed technically "browsers," a term which, however, might also include buffalos. We read that—

"The drought and grass famine previously noticed still continued, and the people of the Bar lands were reduced to great straits. Cattle were driven away to long distances, but large numbers died."

There are some interesting remarks in the report regarding the natural reproduction of deodar, which we give in full.

"*Kulu Division.*—Natural reproduction of deodar was, in May and June, all that could be desired in the forests near Manali, parts of Rupi and Inner Seoraj; but, by the autumn a very large proportion

of the young seedlings had disappeared. Those on the outskirts of the forests, or in more open parts along the roads, are said to have survived more generally. Mr. Lemarchand gives it as his opinion, that the dense undergrowth of shrubs and grasses, which springs up during July and August, is the chief cause of the failure of natural reproduction in deodar forests.

"*Bashahr Division.*—A suggestion, made by the Divisional Officer, points to his observations having been similar to those in Kulu. Mr. Minniken recommends that in good seed years contour-bands should be staked out through the forests, and that all undergrowth suppressing seedlings, should be cleared from these bands during the rainy season.

"The conclusion to be drawn is not new, but may bear repetition.

"Reproduction cuttings in our deodar forests are operations which, even when the forests consist of pure deodar, require to be done with much discrimination and intelligence; the admission of too much light on a dry southern aspect resulting in the seedlings being burnt up, while with the same fault on the colder moist aspects, leafy trees and shrubs get the upper hand, and go far to constitute the new forest. Where the forests contain only an admixture of deodar, the operation becomes more difficult, and the risk of the deodars cut out, being replaced by other less valuable trees, is very great. It is probable that the natural method of treatment by regeneration fellings should be rarely adopted, and that by far the majority of the forests, producing deodar, should be worked by *jardinage* or selection felling. If so, the aim should be to bring our forests to such a condition of irregularity, if it may be so called, that all ages from the seedling to the mature tree are generally represented all over the forest. In due course all fellings would take place over advance growth, and attempts to work for the re-stocking of entire slopes or compartments, with trees of uniform age, would not have to be made."

The Government of India have desired that Mr. Minniken's suggestions should be followed, but do not agree with the Conservator's remarks on jardinage, considering that regeneration fellings when judiciously executed have resulted in sufficient reproduction. In this, we entirely concur, provided sufficient stress is laid on plantations to fill in blanks, which should be of large plants in the cold moist aspects, and on girdling firs and oaks some years before the fellings take place, so as to allow the crowns of the deodar to expand and produce more seed, and cultivating roughly the ground beneath them, to obtain advance growth before the exploitation of the forest commences.

This preparation of the soil has actually been carried out in Chamba, under seed-bearing deodar, and has resulted in the establishment of thousands of young plants. Plantations and cultural operations have been somewhat restricted owing to financial pressure, and only 395 acres under the latter head have been added during the year at a cost of Rs. 7,336, 155 acres shown in previous year being included.

The regular plantations show no increase in area, and their up-

keep, chiefly for the Changa Manga plantation, cost Rs. 23,637, against a yield of Rs. 57,706, showing a profit of Rs. 34,069, from which Rs. 9,692 for carriage of fuel to the market must be deducted, leaving Rs. 24,377 for the actual profits on 15,445 acres of regular plantations, or about Rs. 1-9 per acre.

The following account of the Pabbi reboisement operations, are interesting :—

"The chief cultural operations were those in the Pabbi reserve, carried out during the monsoon. In all 108 acres were treated, and the total cost of the year was Rs. 1,173. The remaining 78 acres of the Dhokanwali basin was contour-trenched at about 6 feet intervals, and trench and ridge sown with *kikar*, *phulai* and *jhand* seed mixed in equal proportions; *tali*, mesquit bean, *pine* and *dhrek* being also tried in favourable localities and in small quantities. A small quantity of *ber* seed was dibbled in behind the ridges, and six maunds of *sanatha* scattered broadcast between the trenches. After the completion of this area the plot of 30 acres purchased last year from Sher Ali, to the south of the Grand Trunk road, was ploughed and sown broadcast with *kikar*, *phulai* and *jhand*; where the ground sloped, trenches 2 feet square in section were made in contours at from 50 feet to 100 feet intervals, and the ridges sown with *tali* with an admixture of *phulai*. 500 transplants, principally *carob*, *dhrek*, *pine* and *lahura* were put out on the cooler aspects of ravines, and 100 *farash* cuttings were put in behind bands. The rainfall was unfavourable for cultural operations, with long breaks and heavy falls during the monsoons. On the 18th August, after one month of drought, 3 inches of rain fell in about the same number of hours, breaking nearly every *band* in the plantation, and carrying away all the dams in the Sar Begam branch of the Dhokanwali *kas*, made by way of experiment as described in the Annual Report last year. These dams did so much good during the time they stood, that it would be advisable to go to the expense of making the large and more important of these in masonry. No method of puddling will ever be effective, where, at certain seasons of the year, not a drop of moisture remains, and the soil cakes and cracks. All *bands* were repaired. Notwithstanding the unfavourable rainfall, the operations are a success, there being scarcely a foot of trench without at least one or two seedlings of *phulai* and *kikar*. The jhand seed was not good: there were few germinations, and the few weakly seedlings, which appeared, soon died off.

"With the exception of the plots in the year 1883-84 work, repaired in 1884-85, which suffered considerably in the dry season, the plantation has maintained itself and is beginning to make a show."

There is nothing calling for particular remark in the chapter on experiments and exotic trees, except that the seeds received from Cape Colony of sneezewood and two kinds of yellowwood failed to germinate, and that the edible chestnut is being distributed amongst the villagers in Kulu and Bashahr, where it bears abundant fruit.

Rs. 7,678, as against Rs. 10,809 in 1884-85, were spent on communications and buildings, a very trifling sum for such a large Circle.

The outturn of the forests roughly calculated for the year is as follows :—

	Cubic feet.
Reserves, ...	71,26,698
Protected forests, ...	91,037
District „	28,10,548
Total, ...	1,00,28,283

over two lakhs of tons.

Of this 28,81,296, or about 29 per cent., was removed by Government agency, as compared with about 25 lakhs of cubic feet in 1884-85.

The timber is principally deodar and pine logs, but includes three lakhs of broad gauge and 22,000 metre gauge sleepers, and 2,000 cubic feet of box-wood.

The following statement gives the result of the sales from depôts :—

"During the year, 6,26,924 cubic feet were sold as against 5,80,873 cubic feet in the previous year. There was a brisk demand for logs, and broad gauge sleepers never commanded a more ready sale.

"The following average pieces per cubic foot were realized :—

Description of timber.	Chamba.	Bias.	Jhelum.	Chenab.	Phillour.
	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.
Deodar logs, ...	0 9 4	0 12 8	0 11 4	0 10 6	0 9 11
Pine logs, ...	0 6 7	0 5 10	0 3 6	0 5 0	0 4 5
Sleepers 6′ 9″, ...	*2 14 1	*3 1 0	...	*2 8 0	...
Waste wood, ...	...	...	0 1 0	0 3 0	...

* Per piece.

The more important local sales comprised the following chief items :—

	Lakhs of cubic feet.	Rate per 100 cubic feet.
Jhand fuel from the Chenab Rakhs,...	$1\frac{1}{2}$	Rs. 7-10
Fuel from Shahdara Plantation, ...	$1\frac{1}{2}$	„ 5-3
„ Changa Manga, ...	$6\frac{7}{10}$	„ 5-0

About 67,22,500 cubic feet, worth Rs. 4,84,309, of timber and firewood were removed by purchasers, whilst the bamboos, grass and other minor produce removed was worth Rs. 1,57,220.

The amount of timber removed by right-holders is estimated at 1,88,000 cubic feet.

The following is the statement of the imports of timber from

Native States, chiefly from Kashmir, as compared with the previous year :—

"These figures compare with those of 1884-85 :—

Description of timber.	1884-85.	1885-86.	More.	Less.
Deodar logs, ...	26,197	41,243	15,046	...
Pine, ...	1,653	3,638	1,975	...
Other logs, ...	10,322	1,09,578	99,256	...
Sleepers, ...	2,72,698	3,05,871	33,173	...

"And show that timber traders brought to market considerably more of each class of timber than in 1884-85."

The revenue for the year was Rs. 8,50,419, and the charges Rs. 6,75,483, leaving a surplus of Rs. 1,74,936.

It is said that the drought has reduced the revenue by about Rs. 45,000, owing to the inability of graziers to pay grazing dues. The chief item of expenditure is Rs. 2,28,405 on Government timber works.

The construction of the Bakani slide, 12,300 feet long, with an average gradient of 1 in 7½, for bringing down deodar logs to the Ravi, was completed during the year at a total cost of Rs. 31,259. This important work has been already fully described in our pages, the plans and execution being chiefly due to Mr. Copeland.

The following interesting remarks of a general character close Mr. Hill's excellent report, which is rendered much clearer by a capital map of the Punjab forests compiled by Mr. Reynolds of the Forest Survey :—

"The experiment in silk culture at Changa Manga, sucessful in the two previous years, failed during the past season, it is said, owing to a few unseasonably hot days. Whatever may have been the cause, about the period of the last moulting and only a short time before spinning, the temperature in the sheds being 97°, disease appeared in every shed simultaneously, and killed off three-fourths of the worms. Further experiment seems unnecessary, for the villagers are not inclined to take up the industry, and private speculators are not tempted to undertake it on a scale likely to be financially successful. It has been shown that cocoons of excellent quality can, under favorable circumstances, be produced at Changa Manga; and, possibly with better sheds, or some special care, or by the regular importation of new eggs, or by the careful segregation of country bred and imported eggs, disease may be avoided, and a regularly good production obtained.

"The cost of the experiment has been—

Year.	Receipts.	Expenditure.	Deficit.
	Rs.	Rs.	Rs.
1883-84, ...	100	163	...
1884-85, ...	729	1,165	...
1885-86, ...	32	1,216	...
1886-87, ...	...	407	...
Total, ...	871	2,951	2,080

Deducted value of 260 lbs. cocoons in stock at Rs. 40 per 80 lbs., ...	130
Rs., ...	1,950
Sheds in stock cost Rs.	1,064

"Mr. J. C. McDonell, Deputy Conservator of Forests, has by careful observations ascertained that deodar seed ripens 14 months after the first appearance of the young cone in the middle of August, while the seed of the *Pinus longifolia* takes from 24 to 27 months to mature. This is the opposite of what was supposed to be the case.

"The deodar forests of the Mandi State, examined by Mr. Gisborne-Smith, were reported upon. It was found that there remain some 13,200 marketable trees, of which 3,000 are not workable, owing to their inaccessibility. If the Trading Company carry out the terms of the contract, and for six years more cut out annually 1,500 trees, they will make a clean sweep; and, for the period necessary for a 2nd class to become a 1st class tree, say 30 years, no marketable deodar will be available. Mr. Wild, when officiating Conservator, proposed to divide the forests into four blocks, and to limit fellings to 1,250 trees once in five years; one block being gone over at a time. This would be a good arrangement, and, provided grazing and fires could be restricted, would be a safe way of working. With fires and grazing the future of the forests will not be secured by any arrangement short of abstaining from all fellings. Proposals, based on the report, have been made by the Commissioner of Jullundur, to modify the terms of the Company's lease, and the matter is under the consideration of Government."

Regarding this we are glad to read as follows in the Government of India orders on the report :—

"The deodar forests in the Mandi State are evidently doomed to rapid destruction under the provisions of a contract entered into by the State with a Trading Company, and His Excellency the Governor General in Council is pleased to observe that the Punjab Government has taken notice of this eventuality, which must seriously affect, not only the State in question, but the underlying country naturally dependent on the forest resources of Mandi."

III. Notes, Queries and Extracts.

Forest Management at Simla.—The following is the account of Municipal forest and gardens at Simla for 1884 :—

	Receipts.	Expenditure.
	Rs.	Rs.
Forest, ...	6,369*	2,094
Garden, ...	5,455	11,229†
Orchards, ...	...	3,396‡
Planting trees, ...	...	340
Total, ...	11,824	17,059

In the course of the year the Municipality laid out Rs. 29,000 in repairs to drains, roads, and metalling, Rs. 423 in new railings, and Rs. 35,000 in new works, a large portion of which were walls.

From these figures it appears that the Municipality expends annually nearly Rs. 30,000 on its roads and drains, a further sum of Rs. 5,000 on new works, many of which are directly concerned with, and occasioned by, the destruction of the roads by landslips, torrents, and other like causes. At the same time the Municipality is incurring large expenditure on forests and gardens—Rs. 17,000 expenditure against less than Rs. 12,000 receipts.

The question which suggests itself is (1), whether a portion of this expenditure on roads and works might not be saved by a more effective application of the funds now spent on forests and gardens ; and (2), whether these forests and gardens might not, under proper management, become a source of profit.

The process by which the hill-sides in Simla and its neighbourhood are gradually destroyed is, unfortunately, only too familiar to all who know the place. I do not refer now to the wholesale destruction of their property and their neighbours which the neighbouring Rajas have been allowed, in their ignorant and short-sighted abuse of their rights, to bring about. They have put an end, for many years to come at any rate, to

* Exclusive of a payment of Rs. 3,000 by the Raja of Dholepore for arrears of sporting dues.

† Of this, Rs. 5,811 were Capital outlay.

‡ Capital outlay.

the magnificent natural resources of the country. A forest in the neighbourhood of a town or railway is a permanent source of profit. The cutting, necessary for the due growth of the trees that are left, will always supply a good margin on the expenses incidental to its preservation; while the recuperative powers of nature, will in a few years fully repair the effects of moderate and judicious fellings. To burn down acres of forest for the sake of the potato crops, which, for a few years, may be grown on the site: to cut down wholesale for the purpose of sale of charcoal manufactory, and then to allow cattle and goats to browse over the site and effectually prevent as they will the restorative effects of nature, is a process as disastrous financially as it is lamentable from the artistic point of view.

Crores of rupees have been thus wasted by the destruction of forest, all along the Siwaliks from Peshawur to the North-Western Provinces; and the destructive process is still in full swing. Nor is the injury restricted to the site destroyed; the country below suffers from torrents, sudden floods, destruction of roads, bridges, canal-banks, and viaducts, and in many places, from sand-streams, which descend from the ruined hills above and reduce thousands of acres of fertile soil to the condition of a desert. Only since the last settlement there has occurred, in a single district of the Punjab, owing to this cause, a permanent annual loss of land revenue amounting to Rs. 90,000.

The same causes are at work, on a smaller scale, in Simla itself. Large spaces of the hill-sides are in many instances left bare or stripped of all undergrowth. Cattle and goats may be frequently seen trampling down and eating the young plants, which in a year or two would become good trees and hold the soil together. Then a small torrent begins to form; it grows with every succeeding shower; day by day, through the rains, a portion of the hill-side is cut from its sides and deposited on the road below. Presently destruction on a larger scale begins; there is a considerable slip, perhaps a house ruined; and the damage has to be repaired by a huge retaining wall supplemented, probably, by a wooden trough, by which the drainage is passed on, only to work increased mischief at some lower point of the mountain-side.

As a striking instance of this process, I would invite attention to what has been going on, the whole of these rains, round Peterhoff Hill and the road under Observatory Hill to Summer Hill. A huge chasm has been torn in more than one place, and it increases with every fall of rain; and, if the road is to continue practicable, serious outlay will, in another year or two, be necessary in order to carry the road to Summer Hill over the portions of the mountain-side which have been thus destroyed. Many of the ravines on Jacko are becoming year by year more serious, and threaten the safety of the neighbouring slopes. At the top of one of the bare spots, on this hill, from which tons of

soil had just been washed down into the road, I saw, a few weeks ago, goats browsing on what remained of the herbage. Cause and effect were never more clearly in juxtaposition. To turn in another direction, I am informed on excellent authority, that, owing to the neglect to afforest the slopes below the Serai and Slaughter-house, which were once beautifully wooded, the safety of the main bazaar is seriously threatened, and precautionary measures on a large scale are inevitable.

On the other hand, the Municipal woods have evidently been under no intelligent management. Trees are everywhere crowded together in a way which only insures that they shall never be anything but hideous deformities; hundreds of oaks may be seen standing so close that they have no chance of becoming anything but bare poles, while what foliage they have is out of sight, overhead. Splendid young pines are smothered under some wretched jungle stump, when a few blows from the axe would set them free to grow into noble trees. The value of the timber, whose removal is now essential to the well-being of other trees in the Municipal woods, must certainly be very considerable; and the increased growth of the other trees, to which the clearing would conduce, would, ultimately, be another large source of profit to the Municipality, to say nothing of the increased beauty of the forests. As the woods stand now there are many parts where half or two-thirds of the standing trees ought to have been thinned out years ago, in order that they should not ruin their companions, as they are now doing, or have done; and the sooner they are thinned the better will it be for the future forests of Simla. If the Municipality had in its employ an officer acquainted with forestry, such lamentable waste could not occur; and it is a matter of sincere congratulation that the Municipality is now believed to have resolved upon this most important reform.

But the question is not merely of the well-being of the Municipal woods; there is the larger and more serious problem of the fuel-supply of the future. How this has been managed in the past, one has only to go out towards Mushobra, or in fact on any side of Simla, to see for oneself. Whole mountain-sides, covered with magnificent forest trees, have been turned into howling wildernesses, absolutely worthless to their owners, destructive to neighbouring property, hideous to behold and exceeding costly to the Government, which has to keep up means of traffic across them. All this has been the result of barbarous ignorance and waste. No such destruction is necessary. If a sufficient area were conserved, (Mr. Ribbentrop reckons it, I believe, at about 12,500 acres,) Simla might be well and cheaply supplied, without ultimate detriment to the forest or destruction of the soil on which it grows. A good profit might be earned for the Municipality; an immense boon would be conferred on residents; fodder for five times the num-

ber of cattle, who now destroy the hill-sides, would, in a year or two, be forthcoming; the horrible destruction of the mountain-sides would cease, and an example would be set to the surrounding Rajas, by which, when they saw its results, they could hardly fail to profit. Fuel is now thus supplied from the Government forests at Darjeeling, and the system is approved on all hands. The rise in the price of wood and charcoal in Simla, of late years, has been very marked, and must press hardly on the poor. When one sees the wretched little bundles of sticks which the villagers bring in, and for which they get four annas, it is certain that some effectual remedy is essential, if a fuel famine in the future is to be averted. The subject was urged on the attention of the Municipality by Messrs. Hill and D'A. Vincent in 1876, and again by Mr. Hobbert in 1884; it cannot be longer disregarded with impunity.

There are several other matters as to which there is great room for improvement. First, as to the management of private grounds, which abut upon the public roads. There are many of these, where cows and goats have been, and still are, allowed completely to destroy the undergrowth,—where large spaces, accordingly, are left without any protection, and where every shower brings down more or less deposit, and enlarges the torrent bed, which will, sooner or later, involve a larger slip.

Section 120 of the Act enables the Committee of a Hill-Station Municipality to make rules for regulating or prohibiting the cutting or destroying of trees or shrubs, or the removal of soil, "when such regulation or prohibition is necessary for the preservation of the soil, the prevention of landslips or the formation of ravines and torrents." Surely, under this Section, it would be possible to make a rule prohibiting the worst of all forms of destruction, that by cattle and goats. At present, there is nothing to prevent anyone, who is foolish enough to do so, from entirely destroying every young tree in his neighbourhood by allowing animals to browse about at will; and when they stray into a neighbour's grounds, there is no remedy except to send them off in charge of one's own servants to the pound. I have repeatedly seen this season goats browsing on the young foliage by the road-side on properties, where, naturally, the condition of the soil ensures the descent of a portion of it whenever rain occurs. Of course, till goats and cattle are prevented from browsing, nothing can be done in the way of afforesting. A goat will do in ten minutes more damage than a forester can repair in as many months; and there is no doubt that each of these destructive little animals (whose numbers are justly said to be a good test of the impoverishment of a county) destroys, every day that it is at large, more than its own value. I would suggest that, with a view to the preservation of the soil in Simla, the grazing of goats and cattle be everywhere rigorously prohibited, and a penalty under Section 121 imposed

for any infraction of this rule. A tax should be levied on all goats brought into the station, and no one should be allowed to keep a goat who has not a proper stable in which to secure it.

The Section, however, does not go far enough. There ought to be a power to call upon the owner of property to take measures for the prevention of erosion, and, thus, the occurrence of landslips. In many cases the construction of a small drain or of a wattled bund would effectually prevent the formation of a torrent; and if the ground were properly planted, the vegetation would hold it firmly together. An excellent instance of the case, with which bare ground may be afforested and protected from slips, may be seen on the hill-side to the south of the new Government House, where a considerable area of new soil, only deposited last year and without a shrub or blade of grass upon it, has been in a few weeks rendered perfectly firm and is now covered with vegetation.

Another reform would be to place some more intelligent persons in charge of the banks by the road-side than those now employed. At present Municipal sweepers are sent round periodically to cut down excessive vegetation, and trim the hill-side; they perform their task with long sticks with which they smash down indiscriminately all that rises above the soil. On one occasion I found a Municipal servant busy with a large rake raking down a steep bank below my house. Any process more fatal to the growth of young shrubs and trees and more certain to entail the ultimate destruction of the bank it would be impossible to imagine.

Another way in which much might be done to preserve the banks would be by properly cutting back the rose-bushes and other plants of a like character, and keeping them as much as possible as creepers on the soil. This is now wholly neglected, and all the benefit of the useful function, thus performed by such plants, when properly managed, is lost.

There should also be a rule by which the practice of digging out clay from the sides of the banks would be prohibited. It is now carried on utterly irrespective of every consideration except the convenience of the excavator; and, as it frequently happens that the finest trees stand over beds of clay, these trees get undermined and their eventual ruin is secured. As an instance of what can be done in this line, I would invite attention to the state of the road to Summer Hill close to the Viceregal Guard House. The hill-side has been completely undermined. There should also be a rule by which the Municipality could call upon proprietors to build up places where excavations have been made, or where, from other causes, the bank is overhanging the road and likely to fall.

It would be well too if the officer in charge at Annandale were directed to have a supply of young trees and seeds for the use of such persons as desire to plant their estates. Many per-

sons would be glad to plant a few trees, if the means for doing so were provided. If the Municipal Gardener were desired to rear annually a few thousand deodars, chestnuts or acacias, for distribution to house-owners, a marked effect would soon be brought about.

I venture to make these suggestions in the belief that, if the Commissioners would act upon them, a great deal of money might be saved, a great deal of waste prevented, and the beauty of this beautiful place be greatly enhanced.—*Pioneer.*

FOREST METEOROLOGY.*—*Forest Observatories.*—Some time before Dr. Brandis's retirement from the office of Inspector General of Forests with the Government of India, he consulted me on the establishment of observatories in connection with the forests, with a view to ascertaining the effect of forests, more especially on temperature and rainfall. Observations of this kind have been made somewhat extensively in Europe, and the work of Ebermeyer† on the results of five years' systematic observations, at comparative observatories (within and without the forests) in Bavaria, is a well-known standard treatise on the subject.

As the result of this consultation, the first step taken in the Forest Department was to establish an observatory at the Forest School at Dehra Dun, which should serve as a model for the forest observatories and a training school for observers. Arrangements were made, by Dr. Warth, for recording temperature, the humidity of the air and the rainfall near the ground and also 66 feet above it, and these observations have been carried on regularly, from October 1882 up to the present time.

In July 1884, the first pair of comparative observatories was started at the Forest Nursery, Ajmere; they were less complete in plan than the Dehra model, sheds of similar pattern being erected under the trees of the forest and in the open ground outside the forest; and readings of the maximum, minimum and 10h. and 16h. temperatures were recorded with thermometers therein exposed, the instruments having been previously verified at the Alipore Observatory. In this case, rainfall was recorded only outside the forest.

In August 1885, another pair of observatories, similarly furnished, was established at the Mohwa Bir Forest, Ajmere, and from the beginning of the present year (1886) comparative measurements of rainfall have been made both within and without six forests in the Ajmere-Merwara reserves.

In June 1884, comparative observatories were established in

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* Extract from Report of the Meteorological Department of India 1885-86. Reprinted with Mr. Blanford's kind permission.

† Die Physikalischen Einwirkungen des Waldes auf Luft und Boden. Dr. Ernst Ebermeyer. Wiegandt; Hempel und Paery, Berlin, 1873.

the Dún at the Rámgarh forest, and in March 1885, a similar pair in the Rajah of Nahan's forest, by Mr. Fisher, the Director of the Forest School. These are on the same plan as the model observatory at the Dehra Forest School; observations of temperature, humidity and rainfall being recorded both near the level of the ground and also at an elevation of 60 feet above it, on a structure originally designed and constructed by Dr. Warth.

The results of these observations, so far, seem to show slightly but appreciably higher rainfall in the forest than without. Before, however, this can be accepted as a valid generalization, unquestionably a careful enquiry must be made into the possible existence of other circumstances affecting the contents of the rain-gauge, besides that obvious difference of position, the effects of which is the aim and object of the observations to gauge;* but it is certainly noteworthy that the large majority of the comparative observations up to the present time seem to point out in the same direction. They are as follows :—

Comparative measurements of Rainfall within and without forests.

RAMGARH FOREST, DEHRA DUN.

	Rain-gauges on ground.			*Rain-gauges 60 feet above ground.*		
	I In forest.	O Outside.	Difference. I—O.	I In forest.	O Outside.	Difference. I – O.
	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
June (16th-30th), 1884,...	4·07	3·66	0·41	3·88	3·61	0·27
July 1884, ..	26·46	25·64	0·82	26·44	24·72	1·72
August " ..	21·74	21·18	0·56	21·23	19·88	1·35
September " ..	18·78	17·53	1·25	18·01	17·19	0·82
October " ..	0·39	0·28	0·11	0·37	0·26	0·11
November " ..	0	0	0	0	0	0
December " ..	0	0	0	0	0	0
January 1885, ..	4·48	4·20	0·28	4·63	4·56	0·07
February " ..	0·70	0·85	—0·15	0·67	0·77	—0·10
March " ..	0·39	0·48	—0·09	0·36	0·42	—0·06
April " ..	0·55	0·44	0·11	0·50	0·45	0·05
May " ..	5·99	5·35	0·64	5·79	5·06	0·73
June " ..	10·76	10·31	0·45	10·61	9·75	0·86
July " ..	9·90	9·81	0·09	9·88	9·27	0·61
August " ..	44·91	44·64	0·27	44·45	43·56	0·89
September " ..	5·51	6·24	—0·73	5·47	6·06	—0·59
October " ..	0	0	0	0	0	0
November " ..	0	0	0	0	0	0
December " ..	3·49	3·45	0·04	3·52	3·48	0·04
Totals, ..	158·12	154·06	+4·06	155·81	149·04	+6·77

* One precaution that I have recommended to the Director of the Forest School is for the ensuing year to exchange the gauges and measure-glasses used respectively inside and outside the forest.

Rajah of Nahan's Forest, Dehra Dun.

	Rain-gauges on ground.			Rain-gauges 60 feet above ground.		
	I In forest.	O Outside	Difference. I — O.	I In forest.	O Outside.	Difference. I — O.
	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
April 1885, ..	0·42	0·06	0·36	0·36	0·32	0 04
May " ..	3·99	4·69	—0 70	4·04	4·36	—0·32
June " ..	11·70	10 47	0·23	11·42	10·07	0·35
July " ..	10·63	9·81	0 82	9·58	9·47	0·11
August " ..	45·87	47 50	—1·63	45·87	46·99	—1·12
September " ..	2·46	2 43	0 03	2·41	2·40	0·01
October " ..	0	0	0	0	0	0
November " ..	0	0	0	0	0	0
December " ..	3·54	3·40	0·14	3·45	3·43	0·02
Totals, ..	78·61	78 36	+0·25	77·13	77·04	+0 09

Ajmere-Merwara Forests.

	Mohwa Bir.			Madar Hill.			Nag Pahar.		
	Inside.	Outside.	Difference.	Inside.	Outside.	Difference	Inside.	Outside.	Difference.
January 1886, ..	0·10	0 08	0·02	0·15	0·12	0·03	0·08	0·05	0·03
February " ..	0·04	0·03	0·01	0·02	0·02	0	0	0	0
March " ..	0	0	0	0	0	0	0	0	0
Totals, ..	0·14	0·11	+0·03	0·17	0·14	+0·03	0·08	0·05	+0·03

	Dania.			Raygarh.			Dilwara Bir.		
	Inside.	Outside.	Difference.	Inside.	Outside.	Difference.	Inside.	Outside.	Difference.
January 1886, ..	0·30	0·32	—0 02	0·35	0 25	0·10	0 08	0·07	0·01
February " ..	0·05	0·04	0·01	0	0	0	0	0	0
March " ..	0	0	0	0	0	0	0	0	0
Totals, ..	0·35	0·36	—0·01	0·35	0·25	+0·10	0·08	0·07	+0·01

The obvious tendency of these results is to show that the exis-

tence of forest increases the rainfall; and although, at present, the evidence is very far from conclusive, I should be by no means surprised if this tendency is confirmed by further and more rigorously conditioned experience. Even admitting this, it may, however, be contended that the differences shown are but small; appreciable but not important. But this would be a hasty and unwarranted conclusion. The pairs of observatories contrasted are, it must be remembered, in near proximity to each other, in all cases probably less than a mile, in some less than a quarter of a mile apart; and the influence of a forest, if real, does not abruptly end at the boundary of the forest tract, but must extend to a certain distance beyond its borders; while for some distance within those borders, it is weakened by the proximity of the open country. Hence, any difference that may be shown by these pairs of stations in respect of rainfall, in so far as it is dependent on the presence or absence of forests, is probably considerably less in amount than would be shown, were it possible to contrast the rainfall of a large area under forest with that of the same area denuded and brought under cultivation. But it is almost impossible to institute a valid comparison of such areas on the large scale, because we can never be sure that the results are unaffected by conditions other than those which are the especial subject of the test.

If such influence is real, it may be confidently expected that the effects will be much greater in India than in Europe or most extra-tropical countries; such being the rule in the case of those meteorological actions that bear most affinity to that in question. I may cite, as an illustrative instance, the very remarkable diurnal variation of the rainfall shown by the Calcutta registers. In extra-tropical countries, any variation of the rainfall according to the time of day is but small, and to be detected only on the comparison of a very long series of registers. But, in Calcutta, it is so marked as to be a subject of ordinary observation; and the registers of no more than seven years suffice to show that, in the hot season, the rainfall at 7 P.M., the hour of maximum, is more than twenty times as great as at 6 A.M., which is that of minimum rainfall.

The question of the influence of forests on rainfall has lately been made the subject of a very interesting paper by the eminent Russian Meteorologist Mr. A. Woeikoff. In this, he draws largely upon India for evidence in support of his view, which is substantially that which I am myself inclined to regard as probable. In some cases, doubtless, the want of local knowledge has led him to over-estimate the effect of forest, and to treat as comparable, with reference thereto, instances which are largely affected by other conditions, such as exposure to winds from a dry quarter, to the prevalence of swamps, and the influence of hills. Owing to this defect in the selection of evidence, his conclusions have not commanded that general assent, to which they

may perhaps hereafter be entitled. For this, we must look to a critical discussion of the further data which our Indian rainfall records are now yielding, and to more extensive observation under the rigorous conditions of scientific experimental enquiry, which it may be within the power of the Forest Department to carry out. But speaking for myself, I must admit that, as the result of the extended experience and enquiry of late years, I have been more and more impressed with the growing evidence in favour of the view which Mr. Woeikoff advocates, and while I must necessarily admit that crucial and convincing proof is still wanting, the general tendency of the evidence is so decidedly favourable, that I can hardly regard the long-suspected influence of forests on rainfall as a question of equally balanced probabilities.

Mr. Ribbentrop, the Officiating Inspector General of Forests with the Government of India, has lately drawn my attention to a case of an apparent increase of the rainfall in consequence of forest protection, which is certainly striking, although, like other cases of the kind, defective in some particulars as evidence and therefore not decisive. In preparing the data for the chart of the average rainfall of India, published in 1883, I had noticed that, the rainfall average of most stations in the Central Provinces was somewhat higher, if derived from the previous 10 or 12 years, than when obtained from longer periods; but as very little is known of the circumstances under which the registers had been kept, I attached no special meaning to the fact. A few months since, however, Mr. Ribbentrop, starting from the fact that extensive tracts of forest, previously devastated by jungle fires with a view to the nomadic system of cultivation practised by the hill tribes, had been brought under protection in 1875, and that thereby the area of vigorous forest growth had been enormously increased, was led to enquire whether this measure had sensibly affected the rainfall, and applied to my office for such records as might throw light on the subject. Comparing the rainfall of the years subsequent to 1875 with that of the years anterior to that date, he finds that the former, in all or nearly all cases, largely exceeds the latter, and he attributes this increase to the preservation of the forests.

The region which must be chiefly affected, supposing that forest protection has really had the influence attributed to it, would be the Satpura, the hilly tract that runs across the Central Provinces between the Nerbudda and the plain of Nagpur and Raipur. For this region, we have complete rainfall registers extending from 1865 or 1867 up to the present time, at the stations enumerated in the following table. I have taken the average of the annual rainfall from the 9 to 11 years ending with 1875, and also that of the subsequent 10 years. The comparison of the two is shown in the following table :—

	Forests unprotected.		Forests protected.		
	Period.	Average rainfall	Period.	Average rainfall.	Increase of annual average.
		Inches.		Inches	
Badnur, ...	1867–1875	39 83	1876–1885	47·83	+8·00
Chhindwara, ..	1865–1875	41 48	1876–1885	48 48	+7·05
Seoni, ...	1865–1875	52 07	1876–1885	54·76	+2·69
Mandla, ...	1867–1875	53 58	1876–1885	56·32	+2·74
Burha, ...	1867–1875	64·51	1876–1885	71 65	+7 14
Bilaspur, ...	1865 1875	41·85	1876–1885	54·81	+12·96
Raipur, ...	1866–1875	51·59	1876–1885	54 41	+2·82
Average, ..		49·27		55·47	+6 20

The rainfall registers of Jubbulpore at the northern foot of the Satpuras, and that of Nagpur on the south, the one extending over 40 years, the other over 37 years, show that the average rainfall of a station, if derived from a period of 10 years only, has a probable error of 5 per cent., or of between 2 and 3 inches in the case of the stations enumerated. Further, it appears from a tabular summary of the rainfall of India since 1864, that the annual average of the whole country, for the 10 years, 1876-1885, was 0·66 inch greater than that for the 11 years, 1865-1875. About half the average difference shown in the above table of the Satpura stations must then be deducted, before we are justified in regarding the increase as even probably the result of some cause locally operating. The residue may fairly be regarded as indicating some such cause, but having regard to our ignorance of the circumstances under which most of the rainfall registers have been kept, it could hardly be confidently asserted that that cause is the conservation of the forests, and no other. Nevertheless, the facts, if not logically convincing, at least may be regarded as an addition of some importance to the accumulating evidence bearing on the subject.

THE RE-AFFORESTING OF IRELAND.—With reference to the re-afforesting of the waste lands along the western coast of this country, where poverty is continuous, authorities have from time to time declared that the climate of the whole island suffers from the damp and desolated heaths of Connaught and Donegal, that in those districts poverty exists, that from the presence in the country of supplies of timber many industries would spring, and that forests (unlike some other State works) cannot possibly end the loss of the public funds. It is understood that forestry would be among the first works that an Irish Parliament would undertake, but it should not be forgotten that the cost of plant-

ing the four million acres of waste lands here suitable for timber must be enormous, and that even at £3 10*s.* an acre over £14,000,000 would be required. If the waste lands are not to remain waste, it is evident that every acre planted now may be taken as money saved to an Irish treasury. There is no prospect that, under Home Rule, planting will be undertaken as a private investment any more than it is at present. Forestry differs from other investments in the years that must necessarily elapse between the planting of the trees and the payment of a dividend. At the end of fifteen years 5 per cent. will be generally made from timber; in twenty years, 10 per cent.; while in thirty years, and onwards, an annual income equal to the whole original outlay may be generally looked upon as certain. But the distant prospect of a dividend, however great, has but comparatively little attraction for the investing public, and it is this first and unproductive period that is retaining so much land in its state of waste and treeless swamp.

Dr. Lyons, in the bill which he introduced in 1884, suggested that "forest loans" should have a period of twenty years, of postponed interest, after which both principal and interest should be repaid together. A considerable move could be made if two-thirds, or even one-half, of the required capital were allowed to stand until the timber began to pay, and in this direction the Legislature might make a liberal advance. The old system of baronial guarantees, as well as of forests, has altogether broken down. Baronies, where poverty and waste lands abound, are not in a position to give any guarantees, and with them, as with private investors, the unproductive period has proved an insuperable obstacle. But the great measure of re-afforesting this country must be made by the Government themselves. Let them form a forest department, as has been already done in India, and in many European States; let them become owners of large tracts at present waste, and undertake the work themselves. At the end of the non-productive period the new forests might be sold for many times their original cost. Security for the money would be absolute, the Government would hold the forests, and in ten years they would have their choice of either selling their property or of continuing the work, as is being done by the Government of other lands. It is submitted that £500,000 would be sufficient to make a great and successful experiment, and that whenever two million acres are planted in Western Ireland the thousands of idle hands would be employed in districts where at present emigration appears to be the only hope for many.—*Timber Trades Journal.*

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THE FOREST OF THE OUTER NORTH-WEST HIMALAYA;* *by* D. BRANDIS, C.I.E.

THE Himalaya forms the northern boundary of India for a length of 24 degrees of longitude. The numberless rivers and streams (which carry off the water of the melting glaciers from the higher mountains, the monsoon rains of the summer, the winter rains of the outer mountains, and the winter snow of the higher chains) unite in three great streams, of which two, the Ganges and the Brahmaputra, flow into the Bay of Bengal, whilst the Indus flows into the Indian Ocean. Simla lies on the water-parting between the Indus and the Ganges, whilst Darjeeling, the eastern large hill station for Europeans in the Himalaya, is situated on the water-parting between the Ganges and the Brahmaputra. The western half of this mountainous region takes a north-westerly direction. The North-Western Himalaya is distinguished from the Eastern Himalaya. Simla lies in the north-western, and Darjeeling in the eastern portion.

The forest vegetation of the Eastern Himalaya is nearly related to that of Eastern Asia, Indo-China, China and Japan, whilst in the North-West Himalaya, the forests of the temperate zone at a height of 6,600 feet and above (in spite of some resemblances to those of Japan and China) belong essentially to the flora of Western Asia, and have a great resemblance to the forests of Europe. The vegetation of the high mountains in the neighbourhood of Darjeeling, and that in the neighbourhood of Simla, have only a small number of species in common; they have an entirely different character, which is striking even to the unprofessional eye.

There is, however, no clearly marked boundary between the

* Translated from the German.

vegetation of the Eastern and Western Himalaya, the transition being very gradual. As Sir Joseph Hooker showed in his masterly introduction to the Flora Indica of Hooker and Thomson as early as 1855, Nepál is the region where the transition of the floras of the Eastern and Western Himalaya takes place. A few facts to prove this may here be mentioned. *Quercus serrata*, Thunb., on which the Yamamái silkworm is fed in Japan, and one of the few Indian oaks which are not evergreen, reaches its western limit in Nepál, and this is the case with many trees of the families of the *Magnoliaceæ* and *Laurineæ*, to which the high mountain forests of Sikkim owe in part their great variety. On the other hand, *Rosa moschata*, the climbing rose of the Western Himalaya, find their eastern limit in Nepál.

Here we will confine ourselves to the part of the Himalaya which lies west of Nepál, the eastern boundary of which is formed by the Sárda or Káli, a large tributary of the Ganges. In this part of the mountains lie Kashmir, Basáhir, Tihri and other States governed by Native Princes, while some of the mountain districts of the Punjáb, as well as Jaunsár, Garhwál and Kumáon, are under the British Government.

In the North-West Himalaya, the snow line lies at 16,000 feet, but, on account of the dry climate, it is higher on the northern side, which slopes towards Tibet. As a rule, the forest reaches its upper limit at 12,000 feet. To gain a clear idea, it is advisable to divide the forest vegetation of the outer chains of the North-West Himalaya into three great zones of altitude, the forests at the foot of the mountains, and in the deep valleys to a height of 3,000 feet; the middle zone up to 7,000 feet, and the upper or high mountain zone, up to the limit of forest growth. These three zones of altitude, which are here proposed by way of experiment, must not be regarded as sharply defined regions of vegetation, the intention being only to bring the fact more clearly before the mind, that up to a certain height, varying according to circumstances, the families, genera and species of tropical India predominate among the trees, while higher up many forms occur which remind one of Europe, and at a still higher elevation, these make room for a vegetation nearly related to the forests of Europe. The lower zone may be termed the tropical, the middle, the sub-tropical, and the upper, the temperate zone.* Still, here we are considering regions which lie outside the tropics, and although at the foot of the North-West Himalaya many species are found which are natives of the tropics, yet the low temperature of the winter months is not without its influence on the vegetation, even in sheltered locali-

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These zones might be styled, as follows:—
Up to 3,000 feet, sub-tropical.
3,000 to 7,000 feet, warm-temperate, corresponding to Southern Europe.
7,000 to 12,000 feet, cold-temperate, corresponding to Central and Northern Europe.—[ED.]

ties, and it cannot be said that the climate at the foot of the North-Western Himalaya is of a tropical character. The relation of the high mountain vegetation of the Western Himalaya to that of Europe is described in the before-mentioned introduction to the Flora Indica of Hooker and Thomson.

The three above-mentioned zones of altitude are well marked only in the outer chains, which have a moist climate. The further one penetrates in a north-easterly direction, into the interior of the mountains, the drier becomes the climate, and this has an important influence on the vegetation. The trees have a slower growth, natural regeneration is less vigorous, the forests become sparse and more stunted, and at last vanish altogether, until in Tibet and the neighbouring countries only scrub jungle is found on the banks of the rivers, whilst poplars, willows, and fruit trees flourish only by irrigation. At the same time, trees and shrubs occur which are different to those of the outer Himalaya, and among the herbaceous plants of the drier inner Himalaya, are many species indigenous to Central Asia and Siberia.

The region of transition from the moist climate and rich vegetation of the outer chains of the Himalaya to the bare regions of Tibet offer to the geographical botanist a wealth of instructive facts which are, however, beyond the limits of our present subject. Moreover, a clearly defined limit cannot be drawn, though it may be said that, the outer ranges with relatively moist climate have a breadth of about 100 miles. The foot of the Himalayan mountains at Barmdeo on the Sárda river, lies in the 29th, and above Attock on the Indus, in the 34th degrees of Northern Latitude, and the distance between these two places is nearly 560 miles. With regard to its length, the region of the North-West Himalaya, as the boundaries are here laid down, may be compared with the Alps from the Durance to the Danube, between the 44th and 48th degrees of North Latitude.

The forest vegetation at the foot of the mountains does not in any way remind one of Europe. The sál tree which begins at the Sutlej, the eastern tributary of the Indus, and is the predominant tree in the forests at the foot of the Himalaya as far as Assam, belongs to the family of the *Dipterocarpeæ*, which with 167 species inhabits Eastern Asia, and has its botanical centre in Indo-China and Ceylon. Only three species are known in tropical Africa. The sál is a large tree, with a tall straight bole and large leaves, which change in the spring, although the tree never becomes quite bare. From incisions in the trunk a resinous balsam is obtained, which collects in hollow trees as a hard white resin. The timber is very durable, but hard and heavy, and it splits and warps long after it is seasoned. It can only, therefore, be used for beams and coarse work. Sál begins to bear seed early, and bears plentifully and regularly every

year.* The one-seeded spherical fruit, as large as a hazel-nut, is crowned by the calyx lobes, which develope into long wings; it ripens in the most favorable time of the year, in June, at the beginning of the monsoon rains, after the forest fires of the hot weather are at an end, and the seed germinates as soon as it is ripe. All these are conditions which ensure the young sál tree victory over its companions in the struggle for existence, and the result is that, it always grows gregariously, and forms almost pure forests in which other species only occur as subordinate species. North of the Sutlej, a few small sál forests are found, but further to the north-west, the severe night frosts of the winter put an end to the existence of the sál tree, and at the foot of the mountains, are found forests of *Acacia modesta*, the most beautiful of the Indian acacias, which bears in March and April a mass of fine white flower-spikes among its tender young leaves. In Assam, extensive forests of sál along the base of the Himalayas cease at the river Monás (91° E. Long.), although further up, on the north side of the valley of the Brahmaputra, a few small forests are still to be found, and the tree continues to form dense forests south of the Brahmaputra, for 100 miles further east, but the subordinate species become more numerous, and in the very moist climate of Upper Assam other species successfully compete for supremacy with the sál tree.

At the foot of the North-West Himalaya, there are often valleys which run parallel to the direction of the mountain range, and are mostly cut into the rocks (sandstone and conglomerate) of the tertiary formation. These valleys (dúns) are in part protected against the dry hot west winds of the spring months, and here are found the best sál forests of North-West India. In these valleys and on the surrounding hills, the sál tree ascends to 3,000 feet, and belongs, therefore, only to the lower zone.

The best known of these valleys is the Dehra Dún, which is drained by two small rivers, one of which flows to the north-west into the Jumna, and the other in the opposite direction into the Ganges. A great part of this valley is occupied by tea plantations and sál forests, and on the water-parting, lies the little town of Dehra Dún at the height of 2,232 feet (30° 20′ N. Lat.) The mean temperature in the coldest month (January) is 55°, in the warmest (June) 84°, and of the year 71°. In 1882, the lowest temperature was on the 7th January, 35°, in other years, it often sinks below the freezing point.† In the same year, the highest temperature of the year in the shade was 101·6°. This was on the 25th May. The mean yearly rainfall is 73·15 inches,

* Occasionally, as in 1886, the sál seeds with such profusion, that every small blank in the Siwalik sál forests is densely covered with seedlings, which also form a complete carpet over the soil under the forest.—[ED.]

† Frosts occur on bright nights in Dehra Dún on low grounds and exposed places, till the beginning of April —[ED]

and of this, 64·49 inches fell in the four summer months, June to September. These figures will suffice to show the climatic conditions under which the sál tree flourishes. As far as the temperature is concerned, it corresponds to that of Cairo, which lies under nearly the same latitude, but the plentiful rainfall makes a very great difference.

Rawalpindi (33° 4′ N. Lat.) in the Punjáb, lying at the foot of the mountains between the rivers Indus and Jhelum, and, therefore, out of the region of the sál tree, has a higher temperature in the hottest month (June), *viz.*, 89°, but a lower in January, 39°, and in 1882, the minimum was on the 20th December, just below the freezing point. The mean annual temperature is 68°, and the maximum in 1882, was 115° on the 10th June. At the same time, the climate is proportionately dry, with a mean annual rainfall of 33·15 inches. These extremes do not suit the sál, but *Acacia modesta* flourishes in them.

The most important companions of the sál tree belong to families only found in tropical climates, such as *Combretaceæ*, and to others, represented in Europe only by herbs and shrubs, as *Malvaceæ*, *Rubiaceæ* and *Leguminosæ*. Mixed forest composed of species of these and other allied families are found at the foot of the Himalaya, not only beyond the northern boundary of the sál tree, but also within its region, and in addition to these, there occur extensive bamboo forests, which are generally composed of *Dendrocalamus strictus*, a species extending to the north as far as the Biás river, and common throughout the Peninsula and Indo-China, except in the driest parts. If we add to this the dwarf date palm (*Phœnix acaulis*), very common in the forests at the foot of the Himalaya, it is easily understood that the character of the forest flora of this zone in no way reminds one of Europe. In the moist depressions of the eastern Dehra Dún, and still more frequently further east, occur extensive brakes of a climbing palm (*Calamus Rotang*); and several species of *Wallichia*, another species of palm, form thick scrub in the side valleys of the river Sárda, near the eastern boundary of the region.

The forests of sál and other trees occupy the hills and stretches of high land between the rivers, but quite a different kind of forest is found upon the alluvium along the streams issuing from the mountains, and on the innumerable islands formed in these streams, and often washed away after a few years. Sissu (*Dalbergia Sissu*) and cutch (*Acacia Catechu*) are here the most important species. Both are pod-bearing trees, and belong to the *Leguminosæ*, the sissu to the *Papilionaceæ*, but to a genus confined to the tropics; the cutch to the *Mimoseæ*, which are not represented in Europe.

Both *Dalbergia Sissu* and *Acacia Catechu* stand more frost than the sál; they extend westwards to the Indus, and ascend far up into the valleys, the sissu indeed occurring as high as

5,000 feet, while the cutch, like the sál, only reaches 3,000 feet. The *Acacia Catechu* is a widespread tree, it is found through the whole of India, in Burma, Ceylon and in eastern tropical Africa. The sissu on the other hand has a comparatively small area of distribution, it is indigenous only at the foot and in the valleys of the Himalaya. It is not unlikely that the valleys of the Himalaya were its original home, and that the seed was originally carried thence by the rivers into the lower land. Every year the newly-formed islands and other alluvial formations are covered with a thicket of young sissu, sprung from the seed which is carried down by the floods of the summer.

Sissu yields an excellent timber, durable, strong, not too hard, and easily worked. The dark-red, hard, and heavy heartwood of the cutch tree is one of the most durable of the Indian timbers. It is highly prized for oil and sugar mills, and where the tree is common it is used for house posts. The cutch, one of the best tanning materials, is the black extract obtained from the chips of the heartwood boiled down. It is very singular when one steps out of the forests of sál, bamboo, sissu and cutch, in which nothing reminds one of Europe, and sees the neighbouring fields sown with wheat, barley, flax, peas and vetches, and even finds among the crops many of the annual weeds with which we are familiar in Europe. The above-mentioned are the winter crops, which are sown in autumn and harvested in spring, their whole period of growth falling within the cold winter months. The summer crops are completely different. *Sorghum vulgare*, and other large species of millet; *Dolichos*, as well as species of *Phaseolus*, which are not cultivated in Europe; cotton and rice, where the climate is moist enough, or water for irrigation can be obtained. The fields of sugarcane and indigo remind us too that, we are at the foot of the Himalayas, in a climate similar to that of the tropics.

The only one among the many strange trees in this zone reminding us of Europe is *Pinus longifolia*, still only at the upper limit of the lowest zone, and belonging more to the middle zone. Since it often occurs in the immediate vicinity of the sál tree, it may, however, be mentioned here. *Pinus longifolia* is a three-needled pine nearly related to the North American pitch pine and balsam pine (*Pinus rigida* and *Taeda*). Pines are natives of the tropics as well as of temperate climates. The *Pinus Kasya*, which is nearly related to the *Pinus longifolia*, forms extensive forests on the Khasia mountains south of the valley of the Brahmaputra, and in Burma on the mountains between the rivers Sittang and Salween, often with *Cycas* and *Brainea insignis* (which although short in the stem is still a tree-fern) as underwood. Still nearer to the equator, between the 16th and 17th degrees of Northern Latitude, is found another species (*Pinus Merkusii*), which like *Pinus sylvatica*, is two-needled, and forms with *Dipterocarpus tuberculatus*, the In tree

of Burma, extensive forests in the valley of the Thaunggyin river, a large tributary of the Salween.

Pinus longifolia forms the natural transition to the middle zone, in which it rises up to 7,000 feet, and clothes the slopes of the ridges and the sides of the valleys in extensive forests. Its shade is still less dense than that of our pine, and even in canopied forests of *Pinus longifolia*, the ground is covered with undergrowth, or with high grass and a rich flora of herbaceous plants with beautiful flowers.

The following shrubs and trees of the middle zone deserve mention:—*Rubus ellipticus* with yellow fruits, ternate leaves, the leaflets large and nearly circular, the sterile stem thickly covered with long red bristles, resembling a European bramble. It is accompanied by *Berberis Lycium*, a stiff bush with greyish-white bark and small ovate dark-violet berries in short corymbose racemes. *Rosa moschata*, the superb climbing rose of the North-West Himalaya, is nearly related to the common climbing or creeping rose of our woods and forests, *Rosa arvensis* or *repens*, and to the *Rosa sempervirens* of Southern Europe, as its styles coalesce into a column. It covers hedges and high trees in the middle zone, and the dense festoons, bearing a mass of large white flowers, fill the air far and wide with their perfume in May and June. *Rhus Cotinus* is identical with the wig tree, which is widely spread in the south of Europe, and is easily recognized by its round aromatic leaves and the outspread feathery panicle formed by the lengthened sterile pedicels of the inflorescence.

Two other species of this genus also extend over a very widespread area; but while *Rhus Cotinus* belongs to Europe and Western Asia, and finds its eastern limit on the Sárda river, *Rhus semialata* and *succedanea* are trees of Eastern Asia. They are spread over the whole of the Himalaya, and are found in China and Japan. A third species, *Rhus Wallichii*, is very similar to the tree from which in Japan the black lacquer or varnish is made. The fruits of *Rhus vernicifera* as well as those of *succedanea* yield wax, though the extraction of it is unknown to the natives. *Rhus semialata* and *Wallichii* grow between 2,000 and 6,000 feet, while *Rhus succedanea* rises to 8,000 feet.

To the family of the *Cornaceæ* belong two shrubs of the Himalaya, which also occur in China and Japan, *Cornus macrophylla*, Wall., in the Western Himalaya from 3,000 to 8,000 feet, and *Marlea begoniæfolia*, which is found from the Punjáb to Burma between 1,000 and 6,000 feet. Franchet and Savatier have separated the forms which occur in Japan as *Cornus brachypoda*, C. A. Meyer, and *Marlea macrophylla*, Sieb. and Zucc., but C. B. Clarke in Hooker's Flora of British India unites them.

The genus *Rhus* belongs to the family of the *Anacardiaceæ*, which includes several valuable forest trees of tropical India,

as well as the most valuable fruit tree of the country, the mango tree. The mango tree is cultivated throughout the whole of India, and the shade of its dense dark green leaves is, in the hot season, as pleasant and refreshing as its large juicy golden-yellow fruit. In the valleys of the Himalaya, the mango tree is common, but it belongs entirely to the lower zone. If one penetrates into the interior of the Himalaya, one follows, as a rule, the ridges, and forsakes the valleys, because they are so narrow, have too winding a course, and often rise by steep breaks. If a valley is followed, as far as it is practicable, it will be noticed that at a height of about 3,000 feet above the sea, the mango and most of the tropical trees vanish, only a few, especially the cotton tree (*Bombax malabaricum*), with its branches placed in whorls, large scarlet flowers and hard ovate capsules filled with soft wool, extends itself into the middle zone, and is to be found planted in the vicinity of temples, often together with *Ficus religiosa*, up to a height of 4,000 feet. At the bottoms of the valleys extending into the middle zone, quite different trees occur. Fringing the water-courses are seen dense masses of *Albizzia Julibrissin*,* with large flower-heads, fine rosy red stamens, which fully justify the Hindustani name "Golab Resham," the rose of silk. This tree has a wide distribution—it is found in Persia, China and Japan. *Pistacia integerrima* is another tree of the valleys in this zone, nearly related to the two well-known species which occur so often in the evergreen woods of the Mediterranean, *Pistacia Lentiscus* and *Terebinthus*. This tree is important on account of its beautiful heartwood, which is mottled with brown streaks, and is highly prized for fine cabinet work. If we ascend from the valleys to the ridges in the middle zone, we find often on bare stony slopes, only used for pasture, a thorny cactus-like *Euphorbia* with a thick fleshy stem and five-cornered branches generally placed in whorls. Of these cactus-like *Euphorbias* there are in India a considerable number of species. They take the place of the American cactus, and are found most frequently in dry regions on stony hills.

In the neighbourhood of villages up to 4,000 feet, the soap-nut, *Sapindus Mukorossi*, Gærtn. (*S. detergens*, Roxb.) is very often planted; it is a large tree with glossy green pinnate leaves, which form a dense spherical crown. The nuts are used for washing woollen and silk stuffs, and are an important article of trade. This species of *Sapindus* is found in the whole of the Himalaya, in Assam, Sylhet, and also in China and Japan.

Here may be mentioned *Grewia oppositifolia* and *Celtis aus-*

* With *A. Julibrissin*, and *A. stipulata*, a tree occurring throughout India, and ascending to 4,000 feet in the Himalayas, we find along the water-courses with the sissu and other species *Quercus annulata* and *Alnus nepalensis*, the latter ascending in moist vallies to 9,000 feet.—[ED.]

tralis, two trees which are indigenous in the middle zones of altitude, and are planted near villages and fields, and furnish winter fodder for sheep and goats. The genus *Grewia* is very numerously represented in tropical and sub-tropical India, and some of the Indian species are found in Africa, while others extend eastwards as far as North Australia. *Celtis australis* is found up to 8,500 feet. The identification is not quite settled, but at any rate the *Celtis australis* of the North-West Himalaya is very nearly related to the species known in the region of the Mediterranean, and in Western Asia.

A remarkable tree of the middle zone is *Olea cuspidata*, so nearly related to the wild olive of Western Asia, that many botanists consider it to be the same. This tree grows in the arid climate of Afghanistan, Beluchistan, Sind and the Western Punjab. In the Himalaya it extends as far as the river Jumna, and it is remarkable that near its eastern limit, between the Sutlej and the Jumna, it is only found in dry valleys, which are protected by high ridges from the winds which in summer bring moisture and rain from the south. This is the case in the valley of the Sutlej above Wangtu, in the valley of the Jumna under the protection of the high ridge on which Mussoorie lies, at Piuntra, which is protected from the moist winds by a ridge which branches from the Chor, and in similar places in the valley of the river Tons.

The transition from the middle to the temperate zone is effected by *Quercus incana*, an evergreen oak with grey foliage, which is common in the outer ranges with moist climate between 3,000 and 8,000 feet from the Indus to Nepál. Two smaller trees of the family of the *Ericaceæ* are generally the companions of the grey oak. These are *Pieris* (*Andromeda*) *ovalifolia* with white flowers in drooping clusters, and *Rhododendron arboreum*, which in spring ornaments the forests with its scarlet flowers.* This rhododendron grows in the whole of the outer Himalaya, as a rule up to 8,500 feet, and sometimes, but exceptionally, up to 11,000 feet, and it is found also on the higher mountains of the Indian peninsula. *Pieris ovalifolia* is wanting in the mountains of Southern India, but is found on the Khasia mountains, in Burma, and in Japan. The grey oak forms mixed forests with *Pinus longifolia* as well as with the deodar, and this can be especially well observed at Simla, where the three trees are to be found together. Up to a height of 7,000 feet, the drier and warmer slopes, if they are covered with forest at all, are mostly stocked with *Pinus longifolia*, while the moister valleys, and cooler northern slopes are clothed with forests of oak and deodar. At Simla, between 7,000 and 8,000 feet above the sea, the deodar and oak predominate. On the

* Dr. Mayr considers *R. arboreum* of Ceylon and Sikkim as distinct from the Borás of the North-West Himalayas.—[ED.]

ridge between Mushobra and Fágu, which rises considerably above 8,000 feet, is found another belt of forest, in which, especially in cool northern situations, the Himalayan spruce (*Abies* * *Smithiana*) appears, in some places in mixed forest with another species of oak, *Quercus dilatata*.

The grey oak changes its leaves in spring, but without ever becoming leafless. Some of the old leaves fall, while the young shoots grow. These are at first light lilac, nearly white, then violet, so that in May the forests of this oak pass through a remarkable and very beautiful change of colour, before they attain their grey-green colour.

Besides *Rhododendron* and *Andromeda* many other species are found as subsidiary species of subordinate importance in the forests of *Quercus incana*. Such are several evergreen species of *Euonymus*, as well as *Euonymus Hamiltonianus*, Wall., a deciduous species nearly related to *Euonymus europaeus*. This species is also found in the forests of Japan, while *Euonymus europaeus* has a westerly region of distribution, with its eastern limit at the Caucasus and the Ural mountains.

Ilex dipyrena, Wall., a small tree covered in late autumn with red berries like the holly of Europe, is common in Simla and elsewhere, along streams and in other moist places in the region of the grey oak. *Ilex Aquifolium* extends as far as North-East Persia, while *Ilex dipyrena* is confined to the Himalaya.

Several species of the family of the *Laurineæ* in the region of *Quercus incana* remind one of the vegetation of the eastern Himalaya. *Litsæa zeylanica*, Nees., ascends to 8,000 feet in the North-West Himalaya, and with it are generally found some other species of the same family, of which *Machilus odoratissima*, Nees., is deserving of special mention.† This tree spreads itself over the whole of the Himalaya and is common, probably run wild from old cultivation, in the valley of Assam, where the Muga silkworm is bred upon it in the open.

In Kumáon, close to the eastern boundary of the mountainous region here under consideration, grows the beautiful fan palm, 40 to 50 feet high, *Trachycarpus* (formerly *Chamaerops*) *Martiana*, above the belt of *Pinus longifolia* in the region of the oak, Rhododendron and *Andromeda* between 6,500 and 8,000 feet. In this part of the country the ground is covered with snow, as a rule, from November to March.

The climate of Simla (31°6° N. Lat.) may serve to give an idea of the climate of the region of *Quercus incana* and the deodar.

The meteorological station is 7,020 feet high, the mean temperature of the coldest month (January) is 41°, and of the warmest (June) is 67°, while the mean annual temperature is 55°.

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* *Picea* (?).—[ED.]

† Mr. Gamble doubts whether the Himalayan *Machilus* is identical with the Sám tree of Assam.—[ED.]

The moistest period is from June to September, with 52 inches of rain, while 70 inches fall in the whole year. In the year 1882, the lowest temperature 27° was recorded on two days in February, and the highest 86° on three days in May and one day in June. Snow falls from December to March, and often lies for several weeks. As to the temperature, most places in Europe, where the coldest month shows a similar mean temperature, have a considerably higher temperature in summer and the rainfall is of course quite different.

The most important tree of the North-West Himalaya, the deodar, belongs to the high mountain zone. It is true that small groups of this tree may be found planted in the middle zone, especially in the vicinity of temples, but its real region of distribution is between 6,000 and 10,000 feet, and it is sometimes found up to 12,000 feet. In October, the male catkins are developed, and then the ground in the deodar forests, and in Simla the streets, are covered with the yellow pollen. In the following autumn, the thick ovate, cylindrical cones ripen and stand erect on the flat out-spread branches. The scales of the cones fall with the seed, and the pointed woody axis of the cone remains erect.

The following remarks will be better understood if I here at once observe, that among the most important conifers of the North-West Himalaya, the silver fir (*Abies Webbiana*)* is the most shade-enduring, whilst *Pinus longifolia* needs the most light. As far as it has been ascertained up to date, they stand in the following order as regards their relations to light and shade—1*st*, *Abies Webbiana*; 2*nd*, *Abies Smithiana*; 3*rd*, *Cedrus Deodara*; 4*th*, *Pinus excelsa*; 5*th*, *Pinus longifolia*.

The durability of its wood makes the deodar the most important tree of the North-West Himalaya, and the Forest Department has, therefore, in these regions given its chief attention to the preservation and extension of the deodar forests. The deodar cedar differs only by unimportant characteristics from the cedar of Lebanon and that of the Atlas, and it is a very remarkable fact, that this tree (certainly in three forms or varieties) has three separate regions of distribution, the eastern on the mountains of Afghanistan, and the North-West Himalaya from the 66th to 80th degree of Longitude East of Greenwich, the middle on the Antitaurus, Taurus, Lebanon, and the mountains of Cyprus, and the western on the Atlas mountains.

Another very widespread conifer of the North-West Himalaya (*Pinus excelsa*), a five-needled species nearly related to the Wey-

* There can be no doubt, as Dr. Mayr maintains, that *Abies Webbiana* only exists in the North-West Himalaya just below the line of perpetual snow, and that the common silver fir is *A. Pindrau*. Dr. Mayr, who has thoroughly studied the conifers of Europe, America and Japan as they grow in their native forests, also considers that *Abies Smithiana* should be *Picea S.*—[ED.]

mouth pine (*Pinus Strobus*), has also two regions of distribution separated by a wide interval. The eastern region of distribution stretches from Afghanistan along the whole chain of the Himalaya to Bhutan, therefore from about the 65th to the 96th degree of Longitude, while the same species was found by Grisebach on the mountains of Macedonia, and first described by him as *Pinus Peuce*. It was also discovered afterwards on the mountains of Montenegro. By means of several complete specimens Hooker established the identity of *Pinus Peuce* and *Pinus excelsa*, and it was recognized by Grisebach in his reports on the progress of the geography of plants.* Hooker has rightly said of *Pinus Peuce* and *excelsa*, that to the origin of these species are attached the most remarkable botanical problems. The family of the conifers numbers still other species, which have a very extensive region of distribution separated by wide intervals. I will only mention *Pinus Cembra* which grows in the Alps and Carpathians, and then is first found again in the north of Russia, from whence it stretches over the Ural mountains as far as Eastern Siberia. The yew (*Taxus baccata*) is indigenous to most forest regions of Europe, but has now disappeared from many places. It is found also in the Caucasus, through the whole of the Himalaya, on the Khasia mountains, in Manchurea and on the Amur. The Japanese *Taxus* is by many people, probably incorrectly, considered to be another species and named *Taxus cuspidata*. *Juniperus communis*, the common juniper, is found in every country of Europe, on the Caucasus, in the drier regions of the North-West Himalaya, in Siberia, as far as Kamtschatka, in Manchurea, on the Amur and in Arctic North America. It is not intended here to enter upon the history of the development of the conifers, but only to point out, that the conifers of the Himalaya are of special importance in the study of the geography of plants.

Pinus excelsa flourishes best in the upper half of the high mountain forest region, often above 10,000 feet, here I have often found dense forests, with an average height of 160 to 170 feet. I mention this, because that excellent observer (who died too soon) Dr. W. Hoffmeister, who in 1845 made an interesting journey through the North-West Himalaya with Prince Waldemar of Prussia, contested the right of *Pinus excelsa* to bear its name, and gave its height as at most 40 to 50 feet. It is true that the deodar attains a much greater size, for I have measured a tree 250 feet high, and deodars growing in the open attain a girth of more than 40 feet. *Pinus excelsa* needs no protection in its youth, and as it bears seed plentifully and at an early age, and the seed is easily carried away by the wind, it reproduces itself in great numbers on bare slopes, especially where sheep and goats are not too numerous. In the high mountains of the

* Can this be conclusively settled from mere herbarium specimens unless Sir J. Hooker had seen both pines growing in the forests?—[ED.]

Himalaya descending strips of *Pinus excelsa* in the midst of other forest mark the course of old avalanches, and down to 5,000 feet are found large areas of land, which were formerly bare, now covered with secondary forest, composed mostly of this pine. In this way the fact is explained, that in the middle zone, the blue pine is often found hung with the festoons of the white climbing rose. Such a capability of spreading is not granted to the deodar. The tree begins to bear seed after it has attained a considerable age, the seed years occur seldom, the seed is heavy, does not fly far from the tree, and the young plant needs protection. But where, in not too densely stocked oak forests, or in their vicinity, are found some old deodars, there is soon found young growth; in a few years the vigorous, although tender drooping leading-shoot of the deodar grows through the protecting crown of the oak into the light, and in this manner begins in many cases a gradual conversion of the broad-leaved forest into a mixed forest in which the deodar finally obtains supremacy. The sides of the ridges on which the houses in Simla are built were formerly partly clothed with a forest of *Quercus incana*, only here and there stood old deodars, especially in the vicinity of former Hindu temples, as well as a few young woods of deodar. Since I came to Simla for the first time in 1863, many slopes then stocked with oak, have changed their appearance, and without artificial aid,* the deodar has filled up the blanks between the old oaks.

Neither the deodar nor *Pinus excelsa* or *longifolia* have, with the exception of *Pinus Peuce*,† corresponding forms in Europe. A more home-like scene discloses itself, if one follows the ridge from Simla, from which the water flows eastwards into the Giri, a tributary of the Jumna, and westwards into the Sutlej, one of the five main streams of the Indus. We take our stand on the Hattu, a prominent peak formed of gneiss, 10,500 feet high, which is 24 miles in a straight line distant from Simla, and twice as far from the foot of the Himalaya.

In the spring the ground is covered with a rich flora of coloured anemones, and in moist places is carpeted with delicate primroses, the species different, but the genera the same as those of Europe. An extensive view is obtained. To the north is the deep valley of the Sutlej, 8 miles distant in a straight line, but 8,000 feet lower down, for the bottom of the valley has an elevation of 2,500 feet. The road into the valley runs down the north slope, mostly through forest, and shows the succession of the different zones in the clearest manner. On the other side of the Sutlej valley, 60 to 70 miles northwards, lie Deotiba and the other snowy mountains, from the foot of which the Bias takes its rise, the second main stream of the Indus counting

* Except perhaps protection from fire.—[ED.]
† *Pinus Peuce* (?).

from the east. These mountains are 20,000 to 22,000 feet high. Much nearer, only 30 miles in a straight line in a north-easterly direction, are the snowy mountains on this side of the Sutlej, which only rise to a height of 17,000 feet. To the south-east are the superb masses covered with snow, the Banderpunch and others, from which the Jumna takes its rise, and which are known collectively by the name Jamnotri. Exactly in the opposite direction west of the mountains at the source of the Biás river, are to be seen at a distance of 90 miles, the snow-covered ridges of the Dhaula Dhár, which separates the Kángra valley, through which the Biás flows, from the basin of the next main stream of the Indus, the Rávi. Looking from Hattu snow-clad mountains occupy more than 180° of the horizon, from north-west to south-east, and besides this in spring, until the end of May, the Chor, 28 miles to the south, is covered with snow. This remarkable mountain, 12,000 feet high, and only 34 miles distant from the plains, is an isolated mass of granite gneiss, surrounded by shales and wacke, which in the neighbourhood of Simla occupy the space between the tertiary formation of the outer mountains and the gneiss of the inner ranges.

Let us turn our attention from the distant snowy mountains, to the region of forest of the ranges which lie nearer to us.

The first thing noticeable, is that the northern slopes are clothed with forest, and the southern slopes are mostly bare. As already mentioned, the road from Simla follows the watershed between the Sutlej and the Giri. As far as Fágu this ridge has a direction nearly due east, and then turns to the north, and so it happens, that when one goes from Fágu to the Hattu many bare slopes are seen, while if one looks back from one of the high points only beautiful north slopes clothed with forest are seen. In other places in the North-West Himalaya this can be seen even more plainly. From the Karamba peak, a point 10,000 feet high, on the watershed between the Tons and the Jumna, to the north, mountains up to a height of 8,000 feet appear bare, whilst to the south, wooded northern slopes are seen. The influence of the aspect on the growth of forest is very great in the mountain regions of India. In the valleys of the Pegu Yoma mountains in Burma, (where the most valuable teak forests in British territory are,) especially on the east side towards the Sittang river, the northern slopes are often covered with dense evergreen forest, while the warm southern slopes bear forests of teak and other trees which are leafless in the dry weather.

The panorama from the Hattu also shows, that while up to a height of about 8,000 feet above the sea the southern slopes are often bare, and the northern slopes often covered with forest, the higher peaks are generally clothed with forest on every side. In many cases indeed, bare southern slopes are found far above 8,000 feet. An example, which is noticed by every visitor to

Simla, is the Scháli, a steep limestone mountain 9,420 feet high, the end of a high secondary chain, which branches from the main chain in a westerly direction 6 miles from Hattu, and from which the water from the south and west flows into a deep side valley of the Sutlej, while the north slopes descend abruptly into the valley of the main stream. On the top of the Scháli the slopes towards the south and south-west are bare, while a magnificent forest composed of Himalayan spruce and silver fir, of deodar and cypress (*Cupressus torulosa*), clothes the north side of the mountain.

From the ridge, which is opposite to the Scháli, and which extends along the south side of the valley, the tops of the trees may be seen peeping over the top of the ridge. The north side of the secondary chain which unites the Scháli with the main chain is clothed with a dense forest of silver fir, whilst the south side bears the remains of fine deodar forest. Here, as elsewhere, the silver fir and spruce are found more on the northern slopes and in moist situations, whilst the deodar in this part of the mountains is more commonly found on the warmer and drier slopes with a southern aspect.

The cypress of the Himalaya does not form such extensive forests as the other conifers, and is generally found on limestone. It is very nearly related to the cypress of the Mediterranean.

The upper part of the Hattu is clothed with forest on all sides, and near the top of the peak is a belt of *Quercus semecarpifolia*, an evergreen oak of slow growth, generally covered with moss, and hung with long pendant grey white lichens, with burred branches, and coriaceous thorny dentate leaves, whose upper side is dark green and glabrous, while the under side is covered with rust coloured tomentum. The acorns ripen in August during the summer rains, they soon fall and germinate rapidly.

Next to this oak, and in part mixed with it, is the Himalayan silver fir (*Abies Webbiana*).* On mountains which rise to the snow line, at the upper limit of forest growth, above the oak and the silver fir is found, as a rule, a belt of birch (*Betula Bhojpattra*, Wall.), often with *Rhododendron campanulatum*, a beautiful species with large flowers. The outer bark of this birch peels off in thin paper-like layers, which are used as writing paper, packing paper and for many other purposes, and it constitutes a not unimportant article of trade.

Below this upper belt, in which the birch, oak and silver fir, and sometimes *Pinus excelsa* are the most important trees, suc-

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* *A. Pindrow* (?) *A. Webbiana* of Sikkim, and accompanying *Betula Bhojpattra* and *R. Campanulatum* in the North-West Himalaya, is nearer to *A. pectinata* of Europe, with much shorter needles and more distinct silver lines than *A. Webbiana*, in which the needles are remarkably long. The general habit of *A. Webbiana* is also quite distinct, with little resemblance to that of the Lombardy poplar.—[ED.]

ceeds a zone in which the Himalayan spruce (*Abies Smithiana*)* predominates, and in which *Pinus excelsa* often forms extensive forests.

The silver fir and the spruce of the Himalaya differ from each other in the same way, as the corresponding forms in Europe. Darker green, stiffer branches, broad blunt needles in a double row, and upright cones characterise the silver fir of the Himalaya, as they do the European species. But in habit, as well as in other respects it is quite different from ours. The crown is narrower, the branches short and burry, and even in the most densely canopied forest, its form is like that of the Lombardy poplar. The Himalayan spruce has pendant cones, pointed leaves, and the last branches droop. These drooping branches are, however, much longer than those of our spruce, so that the trees obtain from them a peculiar character. With these conifers occur two oaks, evergreen like the grey oak of Simla. The one which belongs to the region of the silver fir has already been described. The other is *Quercus dilatata*, a very useful tree, which (as already mentioned) forms beautiful mixed forests with the spruce on the ridge between Mushobra and Mahasu, 6 miles from Simla, on the northern slope of the Hattu, and on many other mountains between 8,000 and 9,000 feet; the wood is very elastic, easily worked, and warps and splits less than that of the other species of oak in the North-West Himalaya, and its leaves are highly prized as fodder for sheep and goats. As auxiliary species of minor importance are found in this region of forest a number of species, which belong to genera with which we are acquainted in Europe. Of these many are not even specifically different. The yew (*Taxus baccata*) has already been mentioned; of it beautiful specimens are often found in the deepest shade of the dense forests of conifers. *Prunus Padus* of the Himalaya is in no way different from the European species, it grows to a large tree, and I have found it as far up as 11,000 feet in company with the walnut, species of maple, the Indian horse-chestnut, an elm (*Ulmus Wallichiana*), and the hazel-nut (*Corylus Colurna*) of the Mediterranean region and of Western Asia. Bird cherry is widely distributed through Europe and the whole of Northern Asia as far as Kamtschatka. The home of the walnut (*Juglans regia*) is perhaps somewhat more restricted. In the Himalaya, it is a true forest tree, and the timber, as well as that of the deodar and *Pinus excelsa* is floated into the plains and there sold for good prices. In the Jaunsár forests between the rivers Tons and Jumna, I have measured trees 100 feet high, with a girth of 17 feet. It is true that here it does not yield such valuable burrs as those imported from the Black Sea and Persia. The nuts of the wild tree have a thick shell and are not edible, but it is culti-

* *Picea Smithiana*.—[ED]

vated throughout the Himalaya, and then yields a splendid nut. The walnut grows wild in the mountains south of the Caspian Sea, but it is doubtful whether it was originally indigenous in Armenia.

The box tree (*Buxus sempervirens*) forms small woods in moist valleys.* It is the same species which is indigenous in Europe and the whole of Northern Asia.

Four species of maple occur in this forest, which are very similar to ours. Nearest to the sycamore is *Acer cæsium* with thick leaves, the underside grey, and fruit with protuberances. *Acer pictum* is strikingly similar to the plane tree, with smooth glossy green leaves, and has diverging wings to its fruit. While *Acer caesium* (the representative of our *Acer Pseudoplatanus*) is confined to the North-West Himalayas, *Acer pictum* is found in the whole of North and Central Asia from the Caucasus to Japan.†

The Indian horse-chestnut (*Æsculus indica*) is very similar to the one cultivated with us. It is often found solitary in moist and shady ravines, but sometimes forms dense forests on the northern slope of the mountains. This tree is easily recognized by its bark, which peels off upwards in long narrow strips.

It would take us too far, if I were to treat of the ash (*Fraxinus floribunda*), elms (*Ulmus, Wallichiana* and *parvifolia*), the hazel-nut (here a tree), the poplars (*Populus ciliata*), &c., the hornbeams (*Carpinus viminea* and *faginea*), the alders, the birches and willows of the Himalaya. What has been said, will suffice to show, that in the forest zone of the high mountains, the number of the different species of trees is very great, and that they for the most part belong to European genera. We find this confirmed, if we glance at the shrubs and smaller trees, which grow in this zone as undergrowth in the forest, or occur on the edge of the forest, or often form scrub jungle of considerable extent.‡

We have made the acquaintance of one species of *Berberis* in the zone of *Pinus longifolia*. The genus has numerous species in India, and among them *Berberis vulgaris*, which with us is at home in the plains; in the Himalaya at 8,000 to 12,000 feet, generally in the forests of silver fir, and particularly common on the edge of grazing places, in blanks in the forest, which are purposely caused by the shepherds destroying by fire one tree after another.

The European genus *Rhamnus* is numerously represented in

* The leaves of the Indian Box are elongated and not round like those of the European species.—[ED.]

† *Acer lævigatum* and *oblongum* have undivided leaves, and the latter is evergreen and descends to 1,800 feet in the Dún.—[ED.]

‡ We must not forget *Cedrela serrata* growing in damp shady vallies up to 8,000 feet.—[ED.]

India, and our two common species *Rhamnus catharticus* and *Frangula* have corresponding forms in two species of the Himalaya. As *Rhamnus catharticus* is recognized by its opposite leaves and branches, and the sometimes hermaphrodite, sometimes monœcious 4-leaved flowers, just so the *Rhamnus dahuricus* of the Himalaya, which in every respect appears so similar that it might be mistaken for it. *Rhamnus Frangula* has its representative in *Rhamnus purpureus*, with alternate leaves, numerous parallel side nerves and pentamerous flowers.

Of the family of the *Caprifoliaceæ*, *Sambucus Ebulus* stretches from Europe to the Western Himalaya, the genera *Lonicera* and *Viburnum* are plentifully represented in our region, and two kinds correspond to European species, *viz.*, *Lonicera quinquelocularis* to *Lonicera xylosteum*, and *Viburnum continifolium* to *Viburnum Lantana*, which stretches from Middle and South Europe to the Caucasus.

It has already been mentioned that the spindle tree *Euonymus europaeus* and the holly, *Ilex Aquifolium*, belong to genera, which are rich in India, and particularly in the Himalaya are rich in species. *Cotoneaster vulgaris*, which has its Northern limit in the Siebengebirge on the Rhine, is found also in Kashmir, and is in the rest of the Himalayas represented by numerous species of the same genus. A rose and a bramble have already been mentioned. Numerous species of *Rosa* and *Rubus* are found in the Western Himalaya, among others the common blackberry (*Rubus fruticosus*), which has its eastern limit on the river Rávi.

The ivy* (*Hedera Helix*) which reaches from Europe, through Northern Asia to Japan, covers rocks and the stems of trees in the Himalaya, as it does in Europe. On the other hand, *Schizandra grandiflora*, a climbing plant belonging to the *Magnoliaceæ*, which in May adorns the scrub of willows, *Euonymus* and *Rhamnus* (especially under the peak of the Hattu, with its large white flowers, brings to memory the magnolias of the Eastern Himalaya, while the white and purple flowers of many species of *Clematis* are suggestive of Europe. In order to some extent to complete the picture of the forest of the temperate zone of the outer Himalaya, the vine (*Vitis himalayana*) must be mentioned, which covers with the festoons of its rich foliage the stems and crowns of the spruce and other trees, up to 9,000 feet, and which in late summer, like the Virginian creeper, turns to a dark red color.

A species of bamboo (*Arundinaria spathiflora*) known throughout North-West India as ringal, forms in the high mountain region dense undergrowth in the woods of *Quercus semecarpifolia*, spruce and silver fir. Like most other bamboos it grows

* The Indian ivy has yellow berries, and differs slightly in its foliage from the European species; it is found as low down as 1,500 feet in Dehra Dún.—[ED.]

in large clumps, which consist of many culms growing close together. As undergrowth it only attains a height of 6 to 10 feet, but in some moist valleys, I have seen pure groups, and then it forms a bamboo forest 20 to 27 feet high. The culm, which as a rule is not thicker than a light walking stick, is brought into the plains in great numbers, and used for pipe stems and other purposes. Formerly the ringal was erroneously named *Arundinaria falcata* or *utilis*, this is another species of bamboo, which belongs to the middle zone, and has no importance as an article of trade.

Just as trees and shrubs in the temperate zone of the North-West Himalaya partly remind us of the flora of Eastern Asia, so do the herbaceous plants. We must confine ourselves here to a few remarks on the perennial plants, which are more important for the history of the distribution of plants, than the annual and biennial plants.

Aconitum Lycoctonum and *Actæa spicata* grow in the dense shade of the spruce forest below Hattu, *Aquilegia vulgaris* is an ornament to the sunny slopes round Simla and along the whole road to Hattu. *Caltha palustris* and *Thalictrum minus* are other *Ranunculaceæ* which are common in Europe, and in the Himalayas.

In a similar way other families are represented, among the *Leguminoseæ* many species of *Melilotus* and *Trifolium* are common to both regions, among the *Rosaceæ*, the strawberry and many species of *Potentilla*, numerous species of *Epilobium*, *Artemisia vulgaris* and many other *Compositæ*, many sedges and grasses.

As already mentioned, the road from the top of the Hattu into the valley of the Sutlej passes in succession through forests of *Quercus semecarpifolia*, silver fir, spruce, some deodar and *Pinus excelsa*, and at last through forest of *Quercus incana* with *Rhododendron* and *Andromeda*.

Then follow the fields. Where water is obtainable, it is carried along the slopes often for miles in skilfully arranged canals, on to the rice fields which are carefully terraced. The fields which are not irrigated bear wheat and barley as winter crops, and are cultivated in summer with different kinds of millet, and in the higher situations also with buck-wheat and species of *Amaranthus* and *Chenopodium*.

Through the fields passes a sunny and at times hot road into the valley, which is here nearly 2,500 feet high. The bottom of the Sutlej valley is bare, here and there are extensive areas of terraced and irrigated rice fields, and the land on both sides of the river, as well as the slopes which are not suited to rice cultivation, are mostly used as winter pasture. Sissu is common, and in the villages are found mango trees, nim (*Melia indica*), persian lilac (*Melia Azedarach*), plantains and some large trees of pipal (*Ficus religiosa*), known by its cordate leaves

drawn out to a long point. This tree, as well as most species of the genus *Ficus*, belong to the lower zone, but some species extend into the temperate zone of the Himalaya.

The Sutlej is a rapid stream; about 45 miles up the valley, near the Wangtu bridge, the bed of the river is 5,000 feet high. Here the lower limit of the deodar forest is about 1,000 feet above the bottom of the valley, while 35 miles further up, at the mouth of the river Teedong, where it flows into the Sutlej, the bottom of the valley is 7,500 feet high, and the last of the deodar forest lie immediately on the river.

Above Wangtu, commences the drier climate of the inner Himalaya, *Pinus longifolia*, *Olea cuspidata*, *Albizzia Julibrissin* and some other trees of the moister region are no longer found. *Quercus incana* goes a little further up the valley, on the river Teedong, *Abies Smithiana* finds its limit, still further up extend *Abies Webbiana*, the deodar and *Pinus excelsa*, the last named species extends furthest. On the other hand above Wangtu, begins the pine with edible seeds, *Pinus Gerardiana* and *Quercus Ilex*, the evergreen oak of the Mediterranean and of Western Asia. In their company are found other species, which demand a dry climate, and which are wanting in the forests of the outer range, *Juniperus communis*, and the tree-like juniper of the North-West Himalaya, *Juniperus excelsa*, the white poplar, *Populus alba*, and of smaller shrubs, species of *Carragana* and *Astragalus*, which bring to mind the flora of Siberia. If the Sutlej is followed up still further, the trees become scarcer and smaller, and gradually the transition follows to the treeless regions of Tibet.

A RHYMING REPORT OF THE CONFERENCE SET, AT DEHRA DUN SCHOOL, WHERE SOME OF US MET, OUR COURSE FOR THE FUTURE TO LAY AND TO FIX, IN THE MONTH OF OCTOBER, EIGHTEEN EIGHTY-SIX.

Ho! Mr. Director, and pray how are you?
Broun, Hearle and Fernandez and A. Smythies too;
We're come to examine, according to rule
Your famed institution, the Dehra Dún School.
Please trot out your scholars, one, two, three and four,
We would like just to test them, to see how the store
Of learning you pour on them sticks to their brains;
We are sure that none of you spares any pains—
But, now, what we want is to see and to spy hence
Whether practical teaching, or theory and science
Take the lead in your work, and instead of the art
Sylvicultural, chemistry taught by your Warth?
Waldteufels—what's that?—as explained by Fernandez,

The pip among beetles, on which Clifford grand is,
Law, botany with its long terms to remember,
Form the staple of work from July to November.
On Surveying, soils, with a road or two thrown in,
Like that to Rámgarh, Campbell-Walker crossed moanin',
And on practical Forestry we all rely,
As the cream of the course, from November to July.
The lads are well dressed, like field marshals they shine,
For badges and buttons and braid all combine
To make a grand show that's uncommonly fine;
Especially when —'t is a teak tree in leaf!—
Madras blazes forth with her great golden sheaf;
And gently we'd hint—to your ears our lips close—
Take heed lest the students' *mores* be *feros*.
Next, turn we to think how our forests to guard
From a pitiless foe, how best to retard
His march o'er the land in one great conflagration,
We say that there's nothing like organization,
And measures adapted his murmurs to quiet,
And win to our side, through his interests, the ryot.

Working Plans should be drawn for the good of the forest,
To meet all its wants and its ills, where they 're sorest;
Still rights of long usage, we all must admit,
Have their place:—we our plans, or our purses, must fit
Such troubles to minimize;—doing our best
To make the Plans square with our Rulers' behest.
How to hit off the classes of trees and their number,
How to cut out the bad ones our acres that cumber,
Sample areas, we think, we may use in a fare way
When forests are constant; but linear survey,
When carried o'er hills, through ravines and through vallies,
Will best meet of critics the questions and sallies,
Provided our lines are straight, even and broad
And from end to end of the woodlands are bored.
When a canopy's formed and the trees are well raised,
We all are agreed that the land may be grazed;
On grazing called *light*, as urged by Berár,
We look with suspicion and think it may mar
The hopes for the future of trees that are growing;
Unless, as explained, it is coupled with sowing,
And from fellings, still recent, the cattle excluded,
Till foresters think them sufficiently wooded.

We say that the officers of the P. W:
Who think 't is enough to say "we will trouble you
To give us wood seasoned, whenever we ask it,"
Should remember, the wisdom of gods it would task it
To grow seasoned trees, all fit for their sleepers,

Their beams and their rafters, their mouldings and reapers,
Or ever they 're felled : so, please, Engineers
Just give us some notice, some two or three years.
And the Forester Indian may serve as the medium
For advertising, without fear of tedium.
In settling our forests, the absolute fact
Of the legal position, alone should attract
The Enquirer's attention, whilst administration
Should not form a part of his notification.

We say that Divisional officers should work
In closest accord with the District head Turk ;*
While financing, and forestry, and discipline too,
Should be left in the hands of Conservators, who
Should be brought into touch with the Governors they serve,
As the muscle and bone with the sentient nerve,
And not be compelled to go up the long avenue
Of Commissioners Financial, or Boards yclept Revenue.

We sifted the list of the terms scientific,
Proposed by Professors, whose craniums prolific
Had sent forth a brood, French, English and Dutch,
On which as we gazed, we said " 'tis too much,"
So with pitiless pencil we scored out two-thirds,
Of the neat little pamphlet so full of long words.

The Sub of the future we settled should be
In rank, morals, and learning of gentle degree ;
An alumnus of Dehra, well fitted to bear
Among his compeers his competent share.
We think that such Subs from the Treasury store,
Might be paid, when deserving, Rupees twenty score,
And trust that his Lordship, in Council, may see
His way to increasing their small salary.
We think that the School should wide open be thrown
To everyone willing to pay from his own
Resources, and able to pass every test
Demanded on entrance, and as for the rest,
He must trust to his luck employment to find,
For Government can't be expected to bind
Itself to all comers, though diligent conners
Of learning, who manage to carry off honours.
We hope that proved merit will find its reward,
And end in assuring bed, lodging and board.
We are driven to say, though the fact we regret,
That in entrance exams our faith is upset,
So we ask *our* Professors to send out the tests
For future exams, and think it is best,

* The poet prays that District officers will consider the exigencies of rhyme.

That heads of departments should see that the men
Sent up to the School, by voice and by pen
Are able to show they are fitted to draw
The fullest advantage from out the deep store,
Provided at Dehra, so ready to fill
Them full of all learning, wit, wisdom and skill.

When our labours were over, we turned to each other,
Smiled sweetly, and said, "Well done! my good brother."
We thanked for presiding our General Inspector,
(To make these lines rhyme, our muse must deflect her straight course, and we trust that the strange collocation of words will be known by this explanation).
We canvassed each other most freely, and still
We part with true feelings of mutual good will;
With the greatest esteem for our hosts of the School,
Who are good fellows all. Then we drew by the rule,
The lines that by custom are known to be set,
For that solemn old ritual, styled *Pomponette;*
Drank a health to old Nancy, whose reign is now gone,
Replaced by the gown of the Cooper's Hill Don:
We've done for the present our best, and we trust
The future will thank us, when we are but dust.

G. J. v S.

THE CULTIVATION OF A WOOD FOR TEA BOXES.

I HAVE been travelling for more than two months through the northern part of India in order to study forest vegetation from the point of view of a forester and botanist. This I was enabled to do with the greatest profit through the kind recommendations of Dr. Schlich of Cooper's Hill and Mr. Ribbentrop, Offg. Inspector General. I must say that, I have not seen many forests in Japan or America more beautifully stocked with magnificent and useful trees than the broad leaved forests of Sikkim, or the coniferous forests of the N.-W. Provinces. I cannot remember all those fine forests without thinking most thankfully of the gentlemen who are in the envious position of studying and working them, and who have not spared time and trouble to show me their forests and the results of their hard work. I may be allowed to mention here Mr. Home and Mr. E. G. Chester of Darjeeling, Messrs. Fisher, Smythies and Hearle of the School Circle, to whom I say "good-bye" through this paper, thanking them most sincerely for their unlimited kindness.

On my way through the Terai, and the hill forest of Darjeeling, I have been told that the scarcity of a timber wood fit for tea boxes is getting more and more felt, owing to the waste

of the various timber trees on private ground. It seems to me a suggestion worth considering would be to propose that the Government should try to cultivate on a large scale a wood for the above-mentioned purpose.

To do that in the quickest, cheapest and surest way, I would recommend the Japanese súji (*Cryptomeria*), or as I will name that tree, the *Sequoia japonica* for the hills around Darjeeling, and the *Paulownia imperialis*, or the Japanese kiri, for the plains and lower hills of the N.-W. Provinces and Punjab.

In Japan, the "súji," or Japanese cedar, is largely cultivated all over the whole empire, but the localities where this tree is found growing wild, are but few, scattered over the main island "Honshin," and these places are rarely seen by any European. There is a mountain north-west of the lake Biwa in the centre of Honshin, covered with large súji trees, evidently wild. There is a broad belt of beautiful forests near Akita, about a fortnight's drive from Tokio, beneath the 40th degree of North Latitude, the winter climate of which country is marked by deep snow for four months, and a temperature, which several times in this season falls to 10° below freezing point. There the súji forms a splendid mass of forests, partly to the exclusion of every other tree, partly together with *Quercus crispula*, *glandulifera*, *serrata*, *grossiserrata*, *Fagus sylvatica*, *Magnolia hypoleuca*, *Æsculus turbinata*, and many other trees; but never is the súji found growing together with another conifer, unless one be planted with it. In such places, the súji attains a height of 150 feet and a girth of 6 feet and more. The tree is also said to be a native of China, and from that country the first seed was brought to Darjeeling by Mr. Fortune, who was sent by the Indian Government to bring supplies of the best kind of the Chinese tea plant. In both Japan and China the tree is usually planted around Buddhist temples, where the finest specimens, towering up to a height of 250 feet (Koyasan), may be seen.

A few years ago, some travelling botanists suggested that the súji is no Japanese tree at all, being brought from China by Buddhist monks together with *Gingko biloba*, *Sciadopitys verticillata*, *Pinus koraiensis*, *Cunninghamia sinensis*, *Podocarpus Nagi*, *macrophylla* and many others; but a careful examination of the Japanese forests from the 35th degree to the 42nd degree, a trip which will take about six months, will show, that only *Gingko* and *Cunninghamia* can be traced back to China.

The economic value of the súji in Japan is very great; growing there in all situations and soils, in deep damp valleys as well as on high mountain slopes; it is one of the commonest and also one of the most useful of Japanese timber trees.

The sapwood is whitish-yellow, from 2 to 3 inches broad, and is, when beams or boards are wanted, generally not removed from the dark reddish, sometimes black-bluish striped heart-

wood. The wood is very light and soft, and is used for all kinds of carpentry amongst the less comfortably situated people; the slight resinous smell of the fresh wood soon disappears.

Owing to the frequent occurrence of earthquakes and disastrous fires, which often lay waste a town with 3,000 houses in a few hours, the Japanese use quantities of wood in house-building.

For that purpose, the cheapest timber in the shortest time is produced by the súji, which is profusely planted all over the empire, and at the age of scarcely 25 years, the trees are cut down and shipped to the market.

The almost exclusive method of propagation, used in Japan is, from a forester's and botanist's point of view, very interesting and important, all plantations being made by *cuttings*. That is not at all surprising, if we bear in mind that the American "big trees" are *Sequoias* too, and coppice as freely as the Japanese one, if cut in an early age and in healthy condition. I remember even a great number of *Sequoia sempervirens* stumps, more than 700 years old, perfectly covered with young and very rapidly growing shoots. Close by Kjoto, the ancient capital of Japan, is a small forest of súji entirely worked as coppice, with a rotation of 20 to 25 years.

For propagation of the súji, the terminal piece of every branch is used, 1½ to 2 feet long. The plantation in the ground must be made immediately before or at the beginning of the rainy season. The Japanese usually put the cuttings 3 to 5 inches deep in the soil, forming a narrow hole of this depth by a wooden stick of about the same thickness as the cuttings; the young plants grow very rapidly after having made plentiful new roots during the rain. This method is preferred to sowing, the young súji seedlings being tender and easily killed by excessive heat or frost. The súji yields a wood that seems to me very well suitable for tea boxes: I am confirmed in this view after having seen tea boxes made of this wood in Darjeeling itself. Such a box was shown to me in the office of Mr. Home, Conservator of Forests for Bengal. Besides that, I am inclined to encourage the plantation of the súji, because this tree apparently grows well in all different kinds of soils and exposures, from the Terai up to the region of the silver fir.

It would be quite easy to grow within a period of from 30 to 50 years wood of the quality and dimensions required for tea boxes, the manipulation of planting this tree being very easy, cheap and sure, if made in the way and at the season above pointed out. In case these lines may induce some experiments, I will add, the young trees must be planted rather close together, scarcely 4 feet apart; for only in a dense growth does the súji soon lose its branches and produce a clean, straight and valuable bole.

The other tree, which I have in mind as timber-yielding tree

for tea boxes is a broad-leaved tree, *Paulownia imperialis*, called "kiri" in Japanese, which produces a wood still lighter and more quickly growing than the súji, but, as Dr. G. King, Director of the Royal Botanical Garden near Calcutta tells me, this tree does not grow well in the wet climate of the Eastern Himalaya, though possibly the north-western plains and hills might suit it.

The wood of *Paulownia* is largely used in Japan, for boxes of every kind, for furniture amongst the better situated classes, and especially for clogs, which are in common use throughout Japan, and which the ladies use varnished and dressed after the newest fashion.

This tree is planted in the villages together with mumo (*Prunus Mume*), nanten (*Nandina domestica*), kaki (*Diospyros kaki*), &c., as a shelter for the kitchen garden or in other accessible places. When the seedlings are two years old, they are cut off close to the ground, and the new shoots grow straight up to a height of 10 feet and more, without a branch in a single year.

In favourable conditions (deep soil), the tree easily attains a girth of 3 to 4 feet within 10 years; these dimensions seem to be sufficient for making tea boxes. In Japan, the tree is sawn off every 8 or 10 years, very close to the ground, and the stool is cleanly cut with a sharp knife. The shoots of the following year grow rapidly and attain even larger dimensions than those mentioned.

As far as I can judge from comparison, the drier climate of the N.-W. Provinces and Punjab, with an average rainfall of from 20 to 50 inches per annum, may prove suitable to this useful tree, which can stand even a good deal of frost. It would be a pleasure to me to provide the Forest Department with seeds from Japan, if my suggestions seem worthy of being considered and proved.

HEINRICH MAYR, *Ph.D. et Oec. publ. Dr.*,
Lecturer in Forest Botany at the University of Munich.

FUTURE ORGANIZATION OF THE FOREST DEPARTMENT.

I WAS glad to read the remarks of "G. J. v S." in your issue for December, and the more such matters as organization and the relations between Conservators and Local Governments or Administrations, and District Forest Officers with Collectors and Deputy Commissioners are ventilated, the better.

Next to the important matters of working plans, settlements and grazing, which should always be approached not only from a professional but from a general point of view, and the scienti-

fic and economic aspect of which cannot be too clearly and repeatedly placed before the non-professional public, there is probably no more important matter connected with the welfare of the Department than its organization and the position of its officers with Government and the officers of the Revenue Department.

Nothing struck me more at the recent conference at Dehra Dún than the feeling of confidence in ourselves and the future of the Department, which the growth of professional knowledge, whether acquired at the Continental Forest Schools or by experience in India, had engendered. It was also very pleasing to a veteran Forester to observe that the greatest freedom of discussion never degenerated into license; that matters of general interest, such as the grazing question, were not discussed or regarded *merely* from a forest point of view, but from the wider stand point of general utility and scientific research; and that there was no tendency to find fault with individuals, whether members of Revenue Boards, Financial Commissioners, or Collectors, measures not men being criticized, and every justice done to the honesty of purpose which animated our colleagues and those placed in authority over us. If we persevere on those lines with moderation, and support our arguments by the hard logic of facts and ocular demonstrations of the benefits of forest conservancy and capability of the Department to govern itself, we must win the day in the long run.

I am entirely in accord with "G. J. v S." in his recommendation that in each Presidency or Province there should be *one head* of the Forest Department solely responsible to Government for its management, and either titularly or practically a Secretary to Government for Forests, in the same manner, as the Inspector General of Forests is virtually, Under Secretary for Forests in the Revenue and Agricultural Department.

It seems unnecessary to represent how greatly such an arrangement would facilitate the prompt and business-like despatch of forest questions. The head of the Department would of course be a selected man of ripe experience, he would be dealing with subjects with which he was familiar, and would be careful not to regard, or attempt to dispose of them only from the forest point of view, any tendency to which would be checked by the Local Government, or head of the Province, and he would be able to give the Government the best professional advice at first hand.

Now I believe I am not wrong in asserting that forest question, more than any others, are dealt with by a number of officers of other Departments perfectly ignorant of the subject, and who change very frequently, whilst the Conservator's views can only reach Government after being filtered through a number of amateur or non-professional channels, and are then dealt with by a Junior Under Secretary, to whom Forestry and its aims and

objects are a dead letter. Under the Departmental head, who might be styled, like the head of the P. W. Department, "Chief Conservator and Secretary (or Under Secretary) to Government for Forests" would come inspecting and controlling officers akin to Superintending Engineers, Deputy Inspectors General of Police, &c. Those inspecting officers, with the Chief Conservator, would form a Board for checking and revising working plans, an important matter, which should not be left to any one officer to deal with however competent he may be.

District Forest officers should be responsible to their own officers only so far as the management of the reserved forests is concerned, and in all matters connected with the discipline, interior economy and finances of the Department, but they may with advantage assist and advise the Collector or Deputy Commissioner with regard to the management of the unreserved forests, in respect of which they might be under his orders.

Such is a brief outline of what I would propose. I fear it will at first appear presumptuous to some of our amateur friends to suppose that a Forest officer could be an efficient Secretary to Government. I remember the same being urged with regard to the P. W. Department, who now have virtually a Chief Secretary, and Joint Secretaries for Irrigation and Railways of their own. Salt, Abkarri, Police, Jails, Registration, &c., have all Commissioners or Inspectors-General, who are really heads of their Departments, and left to administer them more or less as they deem fit subject only to Government. It seems only "Forests," which probably requires greater special knowledge, training and experience than any other Department, except Public Works, which must be dry nursed, controlled and criticized by a series of non-professional and, I regret to say, frequently ignorant and antagonistic officers of another branch of the service.

I am also in accord with your contributor that the pay and position of the Inspector-General of Forests with the Government of India should be improved. He should have the pay and position of other Secretaries, and no Chief Conservator should draw less pay than that of a Collector or Deputy Commissioner, that will I hope and believe all come right in due course, but probably not in "G. J. v S'" time or mire.

I am not altogether with "G. J. v S." in his remarks regarding the young trained officers from Nancy. I feel sure he does not mean to condemn or disparage them, but it strikes me, and will I fear strike them, as rather like "damning with faint praise."

The late Governor of Madras has made certain unfavorable remarks in his final minute, which the trained officers in that Presidency feel very deeply. It is suggested that their education is not good enough, and that they are wanting in enthusiasm. I can only say that so far as my experience goes, and it is pretty extensive and varied, I find the trained officers

as a rule all that can be desired, well educated gentlemen, sportsmen, and full of enthusiasm in their profession and everything connected with it. That is my verdict, and I am not a trained officer in the accepted sense of the word.

Of course it takes some time for a young fellow to gain experience to settle down to work and make himself acquainted with the vegetation and very difficult conditions of Indian Forests and Forestry. Ask any old Civilian of what use is a newly fledged Assistant in either Magisterial or Revenue matters for the first year, aye, or even two or three years in some cases, after his arrival? The answer will certainly, in the majority of cases, be "he is quite useless, I would rather have the help of a Deputy Collector." I cannot say that I believe in the Cooper's Hill training sending us out Foresters, and would personally prefer to see our "young gentlemen" go to Dehra Dún, but I for one will never acquiesce in a word of even apparent disparagement on our French and German trained Forest officers, whom I consider a credit to the Department and to the Empire.

VETERAN.

DR. MAYR'S VISIT TO INDIA.

DR. MAYR, Professor of Forest Botany at the University of Munich, has lately visited the oak and fir forests of Sikkim, the fir and deodar forests of Jaunsar, and the sál forests of Dehra Dún.

He has been deputed, since July 1886, by the Government of Bavaria to study the forest question in America, Japan, Java and India, and especially to ascertain whether any conifers of these countries are suitable for acclimitization in the forests of the Bavarian Oberland, and he is particularly interested in this respect, with the *Cryptomeria* or *Sequoia japonica* and the deodar. Dr. Mayr speaks most despairingly of the American forests, and states that they are rapidly disappearing, and that no serious efforts are yet being made to save what is left of them.

Professor Sergeant of the Haward University, United States, has been deputed by his Government to see the European forests, and is likely to visit India next summer, and as he is one of the Commissioners for the Adirondacks forests, we can only hope that he will be able to stir up public opinion in America on the subject.

A country, which insists on continuing protective duties, and which cannot find ways of spending its enormous revenue, might surely apply some of it to acquire full rights to the waste areas which ought to be maintained under forests, and, which have been inconsiderately alienated to private owners.

Dr. Mayr speaks much more highly of the forest policy of Japan, which is behaving like a civilized State in the treatment of its waste land. The people are strict Buddhists and eat only vegetable food and fish, and, except those who in the last 20 years have adopted European habits, keep no cattle, sheep, or any animals.

Hence their foresters have no grazing question to deal with, and the only reason why some of their hill-sides are bare in places, is because the people cut down the bushes and grass every year to serve as manure.

Dr. Mayr considers that, the Government of Ceylon has been following a suicidal policy, living on the sales of waste-land, which this year landed them in a deficit, and that the tea-planters there are getting splendid crops on the virgin disafforested soil, which will rapidly deteriorate, in the absence of properly protected belts and zones of forest. We are, therefore, very glad to hear that the Ceylon Government has lately applied to the Government of India for a Conservator, and hope that the physical ruin of that fertile island may be arrested by a wise forest policy.

Dr. Mayr identifies the *Abies Webbiana* of Sikkim with the silver fir growing with the *Betula Bhojpatra* and *Rhododendron campanulatum*, at altitudes exceeding 10,000 feet in Bashahr and Tihri Garhwál. The common silver fir of 7,500—9,000 feet of Jaunsár and the Punjab Hill States, is *Abies Pindrau*, and quite distinct from the Sikkim fir.

There can be no doubt, he says, after seeing numerous species of spruce and silver fir all over the world, that the former is a distinct genus, and should be named *Picea* and not *Abies*.

He sees no reason for calling the deodar, *Cedrus Deodara*, instead of *Cedrus Deodár*, the latter being its real native name.

It would be always better that before definitely naming forest trees, botanists who have seen them growing should be consulted, and that their names should not merely depend on a herbarium specimen.

We publish a short paper on the cultivation of the *Sequoia japonica* by Dr. Mayr, and hope to hear more from him after his arrival in Bavaria.

NOTE ON BAMBOOS.

A VERY marked feature of the present year is the manner in which bamboos have multiplied themselves in the Melghát forests of Berár, and in those portions of the plains where they have been cultivated. I noticed this first, during the rains, in the months of July and August, in Ellichpur cantonment, where there are some fine clumps of the Katang bamboo planted on both sides of the Mall and in the Public Gardens. In the Mel-

ghát forests the bamboo is the *Dendrocalamus strictus*. It, too, has thrown up fine healthy culms this year, which are stout and overtop their predecessors. It would be interesting to know if the same thing has been noted in the Khandeish forests of Bombay, and in the forests of the southern and western portions of the Central Provinces, where the climatic conditions have probably been similar this year to those of Berár. The new growth varies from one-sixth to one-third in larger clumps, and in some thinner clumps which were worked a year or two ago, the new growth forms one-half of the whole. There was certainly nothing approaching this reproduction in either 1885 or 1884. It is possible that the bamboo has a short cycle, at the close of which it reproduces itself from the rhizomes in far greater quantities than in the constituent years of the cycle.

The proper working of bamboo forest is an important matter in Berár. Practically speaking, there are now no bamboos except in the Melghát. This lack of bamboos elsewhere in Berár is probably due to the want of knowledge, for bamboo has disappeared in the Kinwat forest in South Berár, where some ten years ago there was a fair quantity. In Dr. Brandis's notes on Berár, published in 1878, he speaks of the bamboo in Kinwat, and says that its reproduction may be left to nature. There has since 1878 been no general seeding of the bamboo in Kinwat, but it is now practically extinct there, and will have to be sown. An old journal that I found says, that in 1881 the bamboo cutters left the forest. They had cut away whole clumps. This is the cause of the disappearance of the bamboo. The proper method is to allow no culms under five years of age to be cut, for up to that age their rhizomes are reproducing. But it is beneficial to the clump that a large proportion of the older culms should be cut out, for if left too long, they hamper the growth of the new culms, and deform many of them. I have noticed in old unworked clumps, growing in hedges and in gardens, that the new rhizomes are frequently crowded so greatly that they are forced up into the clump itself, and form a dense mass some 18 to 24 inches above the ground, and from this mass the new culms have risen. The new bamboos, even when they have pierced their way through the dense crowd of older ones, are inferior to what they would have been had they been standing on their own roots in the soil.

In a *Note on Bamboos* of mine, which you printed last October, I referred to the proper way of working them, but I venture to think that our Berár experience may be again commended to the notice of all who have to do with bamboo supply. Except after a general seeding year, when blocks might be closed to prevent the seedlings being trampled on, I think it is a mistake to close bamboo blocks to cutting. The working of individual clumps is what should be attended to. Nor is it enough to say that so many culms must be left per clump. The culms left

must be five years old and under, as they alone reproduce from their rhizomes. If bamboos are to thrive, they *must be protected from fire.*

In the "Indian Forester" for November 1886, at page 520, your reviewer of the North-West Provinces and Oudh Forest Reports for 1884-85, (old enough in all conscience now,) when writing of bamboo cutting says, "we are not told whether cutting close to the ground, a point we consider of much importance, was attended to or not." Without pretending to be certain on the point as yet, I would say that in Berár where, in the Melghát forests, we have much to do with bamboos, we are inclined to think that cutting them too close to the ground tends to check reproduction. This, of course, does not mean that waste is allowed by cutting them too high up, but about 3 feet from the ground appears to be the best for the welfare of the clump.

Gugumal Forests. G. J. VAN SOMEREN.

GERMINATION OF BABUL SEEDS.

It is, I believe, a common error that goats when fed on babúl pods void the seeds, and thus the seed, having passed through the alembic of the animal's stomach, is better adapted for, and more sure of, germination. In some rules issued by my predecessor in Berár, it is laid down that babúl seed which has passed through goats is to be used when practicable. Where goats are herded at the season when babúl seed is procurable, it is doubtless true that such seed will be found on the ground among the droppings. But I am convinced that the animal has, after eating the pod, ejected the seed some little time later from its mouth, and that the fact of its being found among the droppings is due to the seed being thus quidded out from the mouth and falling where the goats stand. It is due to the capital manuring that the land receives from the manure dropped that babúl groves spring up so well where goats are herded, and not to the seed having passed *through* the goats.

I also doubt whether seeds that have passed through birds are thus rendered more fit for sowing purposes. Birds select ripe fruits, and so the seeds are presumably healthy, and would, in any case, germinate whether they had previously been swallowed or not by the bird. Birds act as distributors only, as far as I can judge. Has it even been proved that the action of the bird's stomach has any beneficial effect on the seed during the short period that it remains inside it?

BERAR,
28th December, 1886. G. J. v S.

II. Review.

REPORT ON GOVERNMENT BOTANICAL GARDENS AND PARKS, NILGIRIS, 1885-86.

THE following extracts from Mr. Lawson's report on the Government Botanical Gardens and Parks in the Nilgiris will interest our readers :—

"*Eucalyptus.*—Major A. C. Smith, R.E., Executive Engineer, Public Works Department, has frequently spoken and written to me about the desirability of growing the better sorts of Eucalyptus in this country, for the purposes of timber. The following species flourish on these Hills :—

"*E. marginatus, siderophloia, calophylla, piperita, obliqua.*—All these are reckoned admirable as timber trees in Australia, and in the course of a few weeks, I could supply the Conservator of Forests with seed of all of them.

"*Castilloa elastica.*—Colonel Campbell-Walker in a letter to the Board of Revenue, states that this valuable *Indian rubber*-producing tree has at last been finally established by Mr. T. J. Ferguson at Calicut. I saw Mr. Ferguson's trees 18 months ago, and they were growing magnificently, and as it has at last been found easy to raise these trees from cuttings, I hope they will in the future form no unimportant item in the forestry of this place. The other rubber-producing plants have so far been a failure, either through their not yielding as much rubber as they do in America, or because we have not yet learnt how to tap them properly.

"*Mahogany.*—In my last year's report, I stated that I had received two casks of the seed of this plant from Mr. Thiselton Dyer. The seed arrived in magnificent order, and was distributed, chiefly to Colonel Campbell-Walker and Mr. Gamble of the Forest Department, and to the Agri-Horticultural Society in Madras. Almost every seed germinated, and tens of thousands of plants must have been raised. From a single pound sown in the green houses at Ootacamund, between three and four thousand plants were obtained, some of these have been sold and the remainder will be handed over to Mr. Gamble.

"I had the pleasure of visiting last autumn the teak forest in charge of Mr. G. Hadfield, Deputy Conservator of Forests, Nilambur. It was a treat to see the grand growth which the teak trees had made during the last 40 years. In the forest were many fine specimens of young mahogany trees, but they were suffering from the ravages of a grub which attacks the buds of all the leading shoots. In other situations the mahogany might not suffer from these pests.

"*Pterxylon utile.*—Mr. Gamble gave me a considerable amount of

the seed of this valuable timber tree, the Sneezewood of South Africa. On dissecting the seed it appeared to be perfectly sound, but on attempting to germinate it in the green houses at Ootacamund, I failed completely, notwithstanding that it was sown under several different conditions. I am glad to hear from Mr. Gamble that, he has been more successful, so this tree will, I hope, be added to the long list of timbers which will in future years adorn our Hills.

"*Coniferæ.*—Several of the Coniferæ grow magnificently on the Nilgiris. (1). *Pinus insignis.*—Trees of six years old are 60 feet in height, and those of 15 years of age yield an abundance of excellent timber. (2). *Cupressus torulosa.*—Though not nearly so rapid as the former, this flourishes well, and at the end of 24 years makes a massive tree of 60 to 70 feet in height. (3). *Cupressus macrocarpa,* and its varieties, grow with surprising rapidity, but from their branching character are more suitable for fuel than for timber. (4). *Cryptomeria japonica* grows well when young, and will, I have no doubt, make a fine tree, but there are none of any great age in the Nilgiris.

"*Tristania conferta, Syncarpia laurifolia, Angophora subvelutina,* and *Grevillea robusta.*—All grow rapidly and make fine trees. I was told that in the Wynaad there were grevilleas which had been planted out only 18 months that were 25 feet in height. It ought, however, never to have been called *Grevillea robusta,* for it has in its living state the most brittle wood. I knew the branches snap off with the slightest breeze, but grown in sheltered places it becomes a noble tree. Its wood is beautifully grained and is well adapted for cabinet making."

WOODEN pavements have long been used in Europe and America, where they have been found to give much better wear than the ordinary materials used for metalling roads. We are glad to see that wooden pavements have been introduced into Calcutta. "Indian Engineering" says :—Our attention has been invited to the gate and portico roadways of the East Indian Railway offices, Calcutta, where wood has been used for the first time in the Indian Metropolis as a surface material for pavements. In this case the pavement consists of rectangular blocks of wood 7 inches deep, set on end, that is, with the fibres vertical, resting on a bed of portland cement concrete 4 inches in depth. The blocks are 4 inches wide, but of variable length, and laid diagonally from the centre line, herring bone bond, on either side. Felting is interposed between the blocks, and the interstices above filled in with gravel or Khaimera. The top edges of the blocks are bevelled, and the pavement presents a neat appearance. These pavements have been extensively used in Russia and America, and were introduced into London in 1835. If we recollect aright a communication to the Scottish Society of Arts showed that blocks so placed with the end of the grain exposed wear less than granite."—*Indian Agriculturist.*

III. Official Papers.

MEMORANDUM ON THE FORESTS OF THE NAHAN STATE, PUNJAB.*

In July last sudden and disastrous floods took place in the Umballa District, which not only interrupted our main artery of traffic by washing away railway bridges and embankments, but destroyed the year's crop over large areas, and covered a considerable extent of country with infertile sand, thereby rendering it unproductive for a number of years.

The disaster was, at the time of its occurrence, discussed in several of the leading Indian newspapers, and was attributed to the denuded state of the once forest-clad hills in the Náhan-Sirmúr State. The question being one of considerable importance, it was considered necessary that Government should be in possession of authentic information regarding the denudation, which, it was alleged, had taken place on a scale sufficient to seriously influence the well-being of the underlying country, and was believed to be still in progress. I was consequently instructed to march, on my way from Simla to Dehra Dún, through the Náhan State, to make such observations as my opportunities would permit, and to note any points which might necessitate further enquiries and possible action. I started from Simla on the 7th October, in company with Messrs. Hill and Popert, the Conservators of the Punjab and Burma, respectively, and we reached Rámpur Mandi on the 13th.

The greater portion of the Sirmúr State is separated from the plains by the high southern watershed of the Giri, which drains into the Jumna where the latter is still confined within the hills. The Batta also, which drains the Kyarda Dún, joins the Jumna before that river finally debouches into the open country, and it is, therefore, only the south-western portion of the State which concerns us in regard to the question under enquiry. Nevertheless, it may be of interest to note that the head-waters of all streamlets which join to form the Batta river originate in compact and particularly dense forests, and that those valleys of the Giri also which came within our observation can, as regards forest growth, favourably compare with other Himalayan valleys.

The areas with which we have at present more particularly to deal are the head-waters of the Mungrail and the Ghaggar;

* By B. Ribbentrop, Esq., Officiating Inspector General of Forests to the Government of India,—dated 4th November, 1886.

next the Márkanda and its tributaries, the Rún and Jojur; and, finally, the numerous *raus*, or torrents, which form the sandy streams in the northern portion of the Jagádhri Tahsil. A glance from any point of vantage on the Dagshai-Náhan road convinces the most casual observer that, as compared with the area under cultivation, a disproportionate extent of the country in the plains below him is covered, as far as the eye can reach, with wide expanses of sandy water-courses.

Whether the mischief is increasing or not, I am unable to say, but there should be no difficulty in ascertaining this from a comparison of the present state of the country with former Settlement records, and I think that we should call for such information, in full detail, in the interests of the inhabitants of the fertile plains which immediately underlie the friable sandstone ranges of the lower Siwáliks.

The head-waters of the Mungrail, the Ghaggar, and the Márkanda and its tributaries, which are situated in Sirmúr, are, without exception, particularly well wooded; and where the country is not terraced for cultivation, it is, at least, covered with a dense shrub growth. The terraces in these valleys show, in spite of a soil loose in character, no signs of sudden and severe floods. The source of the mischief is much more local, and lies, I have no doubt, entirely within the southern portion of the outermost fringe of the highly friable sandstone hills which present a very barren aspect, showing here and there remnants of forests, which even now are admittedly overworked, overgrazed, and annually burnt. They are not as yet so bad as the Hoshiárpur *chos*, nor so barren as the hills to the west of P'injor; but they are approaching this condition.

The tract of country within the limits of which I consider all the harm to the underlying country to arise is, in a political sense, badly situated for interference, seeing that a part of it lies within British territory, that a part forms the very frontier of Náhan, and that a part belongs to Kalsia. The Náhan authorities, who have introduced the Indian Forest Act, and who maintain a Forest Department organized on the model of that of the Government of India, have formed no reserve (*jungal mafusa*) or protected forests within this outer belt, partly because the forests contain no valuable material, and partly, they assert, because they are unable to protect them against the people of the plains living in British and Kalsia territories. None of these forest areas are fire-protected, and are, the Náhan authorities say, fired year after year by the people of the plains, and by others who graze their cattle within them.

Thus the forests which, by reason of the influence that they exercise on the underlying country, should be most scrupulously protected, are here again the least cared for, and that because the interests involved are split up into many inappreciable portions. If somebody derived a good revenue from these forests

by the sale of grass, firewood, &c., it would be in that person's interest to take care of them; but where everybody helps himself, the deterioration of the property is brought about gradually, and without attracting attention, until it is utterly devastated, and ruin is spread over a large extent of underlying country as well.

The disforestation of small drainage areas situated within the friable sandstone hills of the Siwáliks, and underlying the Himalayan range (more especially within the limits of the Punjab), causes the more or less permanent ruin of a large extent of arable country, which is then covered and re-covered by infertile sands; and such sands are, moreover, frequently spread, by the prevailing winds, over still larger areas in the shape of inland dunes. This circumstance has, to my knowledge, been constantly dwelt upon during a period of 15 years and more, and it has been recommended that a limited area in the Hoshiárpur *chos*, near the town of Hoshiárpur, be taken up and closed entirely for a number of years. It is, in my opinion, of the greatest possible importance that these proposals should be carried out, for if it once be shown in practice that such closure results in a benefit to the underlying country, representing many times the outlay on the undertaking, public opinion will enforce the measure from the Jumna to the Jhelum. I think nothing practical will be gained by *opening* the question on the boundaries of Feudatory States; but the opportunity might be taken to point out again with regard to the Hoshiárpur *chos*, that, if it is found at present impossible to effect an interference on a large scale, the question might be taken up experimentally, but at the same time fully, and that at least three perimeters be entirely protected, in order to obtain thoroughly reliable results. Half-measures—such as a restriction of grazing—will yield no practical results, and proposals short of an entire closing should not, under these circumstances, be accepted.

As regards the forests on the borders of the Sirmúr and Kalsia States, I think every effort should be made to stop jungle fires; and the Punjab Forest Department might act in this respect in concert with the Sirmúr and Kalsia Rajas, the former of whom seems to be extremely anxious to effect fire-conservancy in his territory. There is no doubt that successful fire-protection would do much to improve the state of the forests.

NOTE ON THE DESTRUCTION OF THE BLACK WEEVIL.*

THE black weevil is an insect well known to grain-dealers, I suppose, the world over, and especially well known in tropical climates. In India it eats the grain of wheat and maize from

* By Mr. F. W. Cabaniss, Assistant Director of Agriculture, Burma,—dated the 5th November, 1886.

the time it is reaped until it is in the hold of the ship, or made into bread and the bread eaten. It will even eat bread after it has been baked. It is most probably found in every rice, til, wheat, maize, and sorghum godown in Burma.

Like many other insects the black weevil seems to flourish particularly well in Burma. This is owing to the even temperature of the climate, as it dislikes the sudden changes to either heat or cold. It is impossible to estimate the amount of damage caused by this insect in Burma; but it is enormous. A large percentage of the shrinkage in stored grain can probably be attributed to destruction by this insect. It is not detected unless in very large numbers, but when the grain is cleaned by being passed through a fan-mill or winnower, grain which has already been thoroughly clean will show a large amount of dust and a material falling off in the weight of the bulk or bin of grain. The Natives try to combat the ravages of this insect by spreading the grain in the sun and then placing gunny cloth on the top of the grain, when the insect, disturbed by the heat of the sun, crawls out of the grain to the top of the cloth and is then shaken off, and the grain returned to the bin. This method of temporarily getting rid of the insect cannot be followed when there is a large amount of grain in store, on account of the expense of handling the grain.

I have been trying for several years a number of experiments with the object of finding a cheap and simple method of preventing the ravages of this weevil. I think that I have found it in the use of naphthaline powder. My method of using the powder is here given for the benefit of the grain-dealers of Burma. It is best to place the naphthaline powder at the bottom of the bin or bulk of grain. To accomplish this take a bamboo about 1½ inches in diameter and long enough to reach from the top to the bottom of the bulk of grain. Punch the joints out of the bamboo so as to be able to pass a stick through from one end of the bamboo to the other. Have the stick made to fit the cavity in the bamboo. Pass the bamboo with the stick in it down through the bulk of grain from the top to the bottom. Withdraw the stick and drop into the top of the bamboo about half a tea-spoon of naphthaline powder. The bamboo can then be drawn out, as the naphthaline is safe at the bottom of the bulk of grain. If the bulks are large, this should be done one to every 10 feet square of the bulk. Repeat the application every 15 or 20 days as the powder evaporates.

The weevil that can leave the grain will do so, and those that cannot leave are killed by the odour of the naphthaline. I do not believe that naphthaline thus used can cause any injury whatever to grain. For seed purposes the germinating powers appear not to be affected in the least. For marketable grain the colour is not affected, and the odour will leave in a short time if fresh naphthaline is not applied to it. The quantity of

powder used is infinitely small in proportion to the quantity of grain, and the powder is entirely destroyed by evaporation, so that for food purposes the effect is *nil*.

Naphthaline powder can be procured at the Medical Halls in Rangoon, at Rs. 2-8 per ounce, and a few ounces of it will be sufficient for one season for any grain-dealer in Burma.

RETIREMENT OF COL. W. PEYTON.

As Colonel W. Peyton, of the Madras Staff Corps, has, under the operation of Section 110, Rule 10 of the Civil Pension Code, relinquished charge of the office of Conservator of Forests, S. C., the Governor in Council desires to record his appreciation of the excellent service rendered by that officer in the Forest Department of this Presidency. Colonel Peyton was in January 1866 appointed Deputy Conservator of Forests, North Kánara, and was in October 1870 promoted to the office of Conservator of Forests, S. D., which post, with a slight change in designation and with some extensions of the area under his jurisdiction, he has since held without intermission. During the lengthened period he has served this Government he has displayed a rare devotion to duty and unflagging zeal in the interests of the State, which it is the pleasure of His Excellency in Council now to acknowledge. His management of the valuable forests of Kánara, to which he has given special attention, has been particularly judicious, and he has attained marked success at once in expanding the forest revenue without permanent deterioration of the forests, and in meeting the requirements of the population in the most convenient manner.—By order of H. E. the Right Honorable the Governor in Council.

IV. Notes, Queries and Extracts.

Dr. Aitchison on Plants and Plant Products of Afghanistan.—The third meeting of the session of the Pharmaceutical Society of Great Britain was held on Wednesday evening, the 8th December, 1886, there being a fair audience, including about a score of visitors and several country members, and as it ultimately proved, the programme was exceptionally interesting. Surgeon-Major Aitchison, who accompanied the Afghanistan Delimitation Commission as Naturalist, came to tell the members of his experience in the region of the Hari Rud valley, which lies between the north-west of Afghanistan and the north-east of Persia. It is very seldom that a man of science has the opportunity of exploring that region; very few, if any, have done so before Dr. Aitchison, and he has done it so well—both botanically and zoologically—that few are likely to follow in his footsteps, unless to see with their own eyes the wonders which he speaks about. In his "Notes on some plants and plant products of Afghanistan," Dr. Aitchison settles many moot points which have been attached to the umbelliferous gum-resins since they were introduced into European medicine; he has brought home with him a most excellent collection of herbarium specimens, representing fully 800 species, all of them most complete in every part, and greatly enhanced in their value from the fact that his observations on the spot have added much to our knowledge of the life history of the plants. With the aid of a large map, Dr. Aitchison described the ground he went over, pointing out the regions where the more important plants—asafœtida, ammoniacum, and galbanum—were particularly abundant, and he was very happy occasionally in his by-remarks upon the tendency of the natives to mislead the investigator. For example, he was assured that asafœtida was obtained only from the female plant—"The only one which yields milk, you know." Another native tried to assure him that the plant was not the asafœtida-yielding one by eating slice after slice of the root apparently with great gusto. "You see," said the native, "it is not the asafœtida plant." "Bah!" said another, "you'll now stink like a camel for a month." These are fair examples of the difficulties which the investigator had to meet, but as far as we could judge, Dr. Aitchison took the natives' statements for what they were worth. His description of the growth of the plants mentioned was very graphic, and it created no little astonishment in

the audience when he showed an asafœtida stem about six inches in diameter, and explained that one month he had seen the plain upon which it grew arid and desolate, and in three months it was thick with verdure, the *Dorema ammoniacum* and *Ferula fœtida* having grown to shrub-like size in that short period, and given character to the plain by their foliage and beautiful inflorescence. A month later the barren aspect could be seen again. The mystery as to the origin of galbanum he satisfactorily solved with his specimens of the gum-resin and of the plant itself, and Mr. E. G. Baker's proximate analysis of the gum-resin would appear to establish with certainty that it is the true galbanum. The specimen was exceptionally fine, the tears were distinct, pale-coloured, and generally more like ammoniacum, but the existence of umbelliferone in the resin was a conclusive proof of its identity. It is true that the indications of the presence of umbelliferone were somewhat remote, and not so marked as with old specimens; but we yet require some work on this gum, particularly in the direction of ascertaining if umbelliferone is present in recent samples to the same extent as in old ones. In the discussion which followed the botanists had it all to themselves, and it would certainly have been a very dreary affair had not the subjects under discussion long been enveloped in mystery. Mr. Baker, sen., in a very characteristic speech, referred to the value of Dr. Aitchison's work, and gave a very interesting account of the identification that afternoon of the source of royal salep, which Daniel Hanbury in 1856 recognised as different from common salep, derived from orchis species. Hanbury could never get to the bottom of this matter, but now it may be said with certainty that Mr. Baker, in conjunction with Mr. Helmsley, has proved that it is derived from an amaryllidaceous plant, of which he showed a fresh specimen. This was the most interesting point brought out in the discussion; none of the speakers had ever been where Dr. Aitchison made his collection, so that they could not criticise, and therefore the speakers had to be content with the facts as stated, and they warmly expressed their thanks to Dr. Aitchison and their admiration of his work.

The President took the chair a few minutes past 8, and the minutes of last meeting being taken as read, he called upon Dr. Aitchison to read his

Notes on some Plants and Plant-products of Afghanistan.

After Dr. Aitchison had briefly referred to his appointment as Naturalist to the Commission and the work of the body, he described the route by which the company marched to the region where his investigations were chiefly made. That region was situated north and south between Herat and Panjdeh, to the west towards Persia, including the north-east corners of it, and to the east, including the north-west corner of Afghanistan.

His attention was confined to plants which yield products of commercial value, and his work in this direction consisted of collecting botanical specimens as complete as possible, and at various stages of growth, also the ripe seeds for distribution to botanic gardens, such as Kew. He also endeavoured to obtain information as to local names and uses, but his difficulty in many cases was that there was no population from whom he could get that information. Umbelliferous plants are the characteristic type of the vegetation which abounds in the region. This may be on account of the peculiar situation of the plains, which are from 2,000 to 4,000 feet above the sea level. There is no surface water, and none can be got without digging to an enormous depth, yet, strange to say, plants grow on the soil in abundance during few months of the year. He graphically described a plain covered with vegetation, of which the *Ferula fœtida*, *Dorema ammoniacum*, and *Ferula galbaniflua* were the principal individuals. The first two invariably grow together. From the time that the plants begin to grow the plains are one mass of green, then the stems begin to shoot up, and lastly a dreamland aspect is imparted to the scene on the appearance of the beautiful inflorescence. All this lasts from the end of April to the beginning of July, when it disappears as suddenly as it began.

Ferula fœtida.—Dr. Aitchison described this plant as an excellent one in fruit, and referred in detail to its growth. Regarding collection of the gum-resin, he explained that the natives stated that the plant does not yield asafœtida, but he humorously observed they have a faculty for telling travellers things which are very different from what can be seen by careful observation. The collectors come to the plains supplied with sufficient provisions to last them for several weeks. They lay bare the root stock before the flowering stage has been reached, and cut off a portion of the stem, from which a milky juice exudes. Next the root is covered with a dome-like structure of earth and leaves, with an opening towards the north, so that the sun may not hinder the exudation. In five or six weeks they return, and by this time a thick gummy, reddish substance, resembling the asafœtida of commerce, has appeared on the root. This is scraped off and placed in a leather bag. The roots may yield a second supply, but not so abundantly as the first. The asafœtida is then sent to Herat, where it undergoes adulteration to fit it for commerce! Red clay being an important factor in this subsidiary industry. Dr. Aitchison stated that he had found another species of asafœtida-yielding ferula in a different part of the country (Beluchistan), which was distinct from the true *Ferula fœtida*.

Dorema ammoniacum.—This grows along with, and as abundantly as, *Ferula asafœtida*, and in the young state it is scarcely possible to distinguish them, both yielding a juice; but as they grow older, the dorema stem begins to show its characteristic feature—large swellings in the side. It is also recognisable from

the inflorescence, which is different. When at the fruiting stage the plant is attacked by insects, which puncture the stem, from the wounds a juice flows out, which soon concretes. This is ammoniacum. The author had also observed another ammoniacum plant in abundance, *viz.*, *Dorema glabrum.*

Ferula galbaniflua.—The galbanum plant was described minutely, as no previous description of it is wholly correct. After referring to the amplification which is required upon Bentley and Trimen's description of the plant, he stated that it grows very abundantly in the Gulran vicinity. In the young stage the stem has a beautiful semi-opalescent appearance, and as it grows older it is vividly marked with rainbow colours. From an early stage of its growth, it yields by puncture a milky juice which very slowly concretes. This is galbanum. It has a celery odour, and is very adhesive, so that when removed, it generally takes some of the stem with it. This is collected and sent to India, where it is largely used by the people.

The next plant referred to was described as the sumbul plant, which has been identified as *Ferula sauveslus.* It is new to botanists, and we gather that it is the source of the sumbul root of commerce. After reference to some other umbelliferous plants of minor importance, Dr. Aitchison proceeded to describe three new kinds of *manna.* The first is from *Cotoneaster acutifolia*, a tall shrub growing on the hills in thickets. As the plant ripens, the branches become covered with the exudations, which is removed by simply shaking the branches and collecting the manna in a cloth as it falls. A second kind, grown in the vicinity of Rui Khaf, is also new, and the third is obtained from *Tamarix gallica*, not *T. mannifera.* He obtained another specimen from *Salsola fœtidà* in fine tear-like masses, but that had been lost.

The next plant of importance which was described was *Glycyrrhiza glabra.* This is largely collected and is converted into black liquorice by the inhabitants of Turkistan. In the preparation whey is used, this imparting to the extract a peculiar piquancy which is not obtainable by water alone. Liquorice is also largely imported into the country from Persia.

Two species of astragalus, which yield a tragacanth-like gum, were then referred to. This is a peculiar form which exudes spontaneously, and Dr. Aitchison found on cutting a stem that the juice proceeded from the medullary space. It is collected and exported to India, where it is used chiefly for stiffening fabrics. A species of rhubarb, known to the natives as "fool's rhubarb," was found near the Barkut mountains. The root of this is used by natives as medicine. Specimens were shown, and it was stated that some seeds of the plant had been sown at Kew, and plants were now growing from them, so that their identification is approaching. Amongst the other plants referred to were *Micgrinda spinosa*, the root of which was one of the most

nauseous and intolerable smelling substances which he had ever come across. *Astragalus Heratensi*, the source of anzeroot, or sarcocalla, hitherto undetermined, and *Delphinium Zatil*, which yields flowers largely used as a yellow dye stuff in India, the source of which has hitherto been unknown.

After Dr. Aitchison concluded reading his paper, he was heartily applauded, and the President called upon Mr. E. G. Baker to read a note on a sample of Afghanistan *galbanum* collected from *Ferula galbaniflua*.

This being Mr. Baker's first appearance as an original worker, he received a special round of applause. His analysis of the gum-resin brought home by Dr. Aitchison, gave the following results from 5 grammes of the powdered material :—

	Per cent.
Petroleum ether extract, ...	3·108
Ether extract, ...	61 200
Alcohol extract, ...	7·576
Water extract, ...	17·028
Insoluble matter, ...	10·560
Ash, ...	2·463
Volatile oil and moisture, ...	5·332

The water soluble matter, chiefly gum, gave a precipitate with ammonium oxalate and lead acetate, but not with borax. The ash was found to contain sodium and calcium as carbonates, and spectroscopic examination gave a faint indication of storontium. The resin gave a dark-brown colour with sulphuric acid, none with hydrochloric acid in the cold, but a dirty red on boiling, without change on the addition of alcohol. The umbelliferone reaction was obtained with ammonia, and sulphur was proved to be absent. On comparing it with museum specimens, he found some points of identity, but there were also points of difference, and on applying Hirschonn's test for Persian galbanum, it did not satisfactorily respond to it, and his remarks appeared to indicate that Hirschonn's test requires revisal.

Dr. Trimen was then called upon by the President. He commenced by referring in warm terms to the service which Dr. Aitchison had rendered to botanical science by his painstaking and laborious investigations. He was especially pleased that Dr. Aitchison had brought home such a complete set of material, and having himself some years ago worked on umbelliferous plants, he knew how much material for the proper illustration of certain members of the order was required. He then referred to points of difference between some of the plants as brought home by Dr. Aitchison, and the description given of the same in "Medicinal Plants," referring more especially to ammoniacum and galbanum. To a question regarding the frontier of Persia and Afghanistan, Dr. Aitchison replied that the same question had been put by the Shah of Persia to one of his ministers.

After some time the reply was "I refer you to the British," remarks regarding the region where the umbelliferous plants grow, Dr. Trimen concluded by again complimenting Dr. Aitchison on his excellent work.

Mr. J. J. Baker (Kew), the next speaker, made a very acceptable speech. He stated that his Afghanistan work was but a small portion of what had been done by Dr. Aitchison for botanical science, and referred to his note-book of the flora of the Punjab. This was done twenty years ago. During the last Afghan war he had worked up the flora of that country, and now he had thoroughly investigated the region which connects the three great divisions of Asiatic flora. These were the Indian—extensive and rich flora comprising about 15,000 different species; the Siberian, also an extensive and most characteristic flora; and the Oriental, which was rich, and contained most peculiar species. All these seemed to be concentrated in the spot explored by Aitchison. He gave the audience a graphic account of the extent of Dr. Aitchison's work, which comprised zoology as well as botany, and then made his statement regarding royal salep, which first received attention from Hanbury, thirty years ago, and pointed out then in a paper (reprinted in Science Papers) that the royal salep partook more of the character of a bulb than a tuber. But he could not get at its origin, although he made repeated inquiries. A sample of this royal salep brought home by Aitchison was shown which presented the characteristic nucleus, or clove, peculiar to tubers. He contrasted this with Hanbury's figure, and showed them to be identical. Lindley had thought that the royal salep was obtained from some species of tulip, but Mr. Baker said it was nothing like it, and only that afternoon he, along with Mr. Helmsley, Oliver, and Johnston, had been able to refer it to *Unquernia trisphera*, belonging to the natural order amaryllidaceæ. He showed a fresh specimen of the bulb of this plant, and described it botanically. This discovery removes royal salep entirely from the other saleps, and it would appear that it is more like those which grow in Central Africa, and which are used by the Kaffirs. The subject is still being worked up by Mr. Johnston, at the Kew laboratories. Messrs. Hemsley, Jackson, Bentley, and Holmes also spoke, but their remarks were mainly complimentary to Dr. Aitchison, and nothing new was added to the knowledge which was conveyed in the papers read. The President then formally put a vote of thanks to Dr. Aitchison and Mr. Baker to the meeting, and it was carried with acclamation. —*Chemist and Druggist.*

South African Stink or Sneezewood.—The following interesting correspondence respecting this "uneuphoniously named but invaluable" wood has appeared in the *Times*, and, in view

of the proposed manufacture of new rifles, should be fully weighed by the Government Commission now trying to discover the best style of weapon for "Tommy Atkins." If our Colonies can supply a better wood than walnut for gunstocks, and one which is equally cheap, by all means let us have it.

"Sir,—In a most instructive leader of the 11th instant you refer to a Cape wood as 'uneuphoniously named but invaluable.' Doubtless you mean 'stinkwood,' and as it behoves every man to contribute to the welfare of his country by communicating his share of practical knowledge, I respectfully send you this letter, as I believe its publication may lead to important results.

"It may be within the recollection of some of your readers that when, some thirty years ago or so, our officials, with that charming and child-like simplicity which has ever marked our Government in such cases, conducted a certain foreign General over our military store-houses, he exclaimed on seeing the immense piles of walnut musket stocks in the rough, '*Ciel! quelle quantité!*' and went on to ask whence they could possibly be all procured from, when he was answered, 'from France, Monsieur,' the result being an immediate French edict forbidding the export of all such stocks. Now, walnut has for generations been considered the one wood for this purpose. Nevertheless, I set myself soon afterwards to make inquiries, and published a letter in a popular journal referring to one or two Australian woods, and generally inviting specimens of any wood for testing purposes. The only results were a highly complimentary letter from Australia, advising me that the writer had sent me as a present a log of most suitable wood, and that a ship captain had kindly undertaken to deliver it free, as it would lie on deck and not be included in the ship's manifest (a sad blunder, for I should cheerfully have paid the freight, and no doubt it was chopped up by the cook for firewood), and the late Sir Charles Cuyler sending me the stock of a double-barrelled gun, constructed in South Africa of this same stinkwood many years before, which had passed through no end of rough usage. In a long letter his praises of this wood as being suitable for gun stocks were great indeed. Well, the stock reached me duly, and I tried it by every test. I never had seen, nor have yet seen, such an excellent wood for this purpose. Its dull colour and the absence of any of that variety or 'marbling,' sportsmen so much affect were its only drawbacks. Its toughness was beyond belief. On cutting through the fore end with a saw, leaving, say, a quarter of an inch, as workmen do, to be broken off, I found this fraction of the cross-section would not break, although I literally twisted it round and round like a rope, but in vain, finally having to cut it through with a chisel to detach the nearly severed part from the main piece.

"Not to intrude unduly upon your space, permit me only to give, with more than half a century's practical experience, my

opinion that if this can be obtained in sufficient quantities, we possess in our Cape Colony an article of national importance. Walnut is the wood *par excellence* for gun-stocks, for its comparative lightness, its want of a reedy fibre, so that it does not readily split, and its cheesiness on being cut into, and so admitting the close adjustment of wood and iron. But certainly it cannot be called a tough wood, and all sportsmen know how easily a stock can be broken at the handle. Stinkwood, judging by the stock I had, has all the walnut's good qualities. Now, soldiers in the heat of battle have not unfrequently to club their rifles, and use them as their ancestors handled their maces in the days of old. The consequence is that one well-delivered blow may floor an antagonist, but the stock is certainly fractured at the handle, and the gun rendered useless. I do not believe that any such blow could fracture this unhappily-named but extraordinary wood, and I earnestly recommend it—all the more that supplies of walnut are yearly becoming small by degrees and beautifully less—to the notice of our authorities. To your readers I would only add, this is a matter of much more importance than may at first sight appear.

J. D. DOUGALL,
Bennett Street, St. James's Street."

"Sir,—Would you allow me to correct an error in your report of the conference held subsequent to the trials of colonial timber at the works of Messrs. A. Ransome and Co., Chelsea, on the 8th instant.

"I am reported to have said that the wood from the Cape Colony known as umzumbit resisted the attacks of the teredo, a marine borer, which mercilessly destroys most sorts of timber. The umzumbit has been used with great success for bearings for the diamond polishing wheels at the Cape Court of the Colonial and Indian Exhibition, lasting seven times as long as lignum vitæ, but it has never been employed in marine works.

"It is sneezewood (*Pteroxylon utile*) which I mentioned as being of such great value for this species of work, its peculiar smell, from which it derives its name, preventing altogether the attacks of the teredo.

JAMES COOPER, *Cape Forests,*
Marlborough Grange, Cowbridge."

"Sir,—I also can bear witness to the valuable qualities of sneezewood for gun-stocks. Some years ago I was hunting in South Africa, and found that the walnut wood stocks supplied from England did not either meet the exigencies of the climate or the rough work demanded from them, as the desiccating air of the Kalihari Desert quickly shrank the wood and caused the ironwork of the locks and other parts of the rifles to stand out from the gun-stocks. The results were, of course, unreliable locks (taking up dust or damp easily) and constant broken

stocks from brittle wood. During a stay at Colesberg I had sneezewood substituted for walnut stocks, and I gave these most severe trials in another hunting trip into the interior. I found sneezewood to be without any of the faults of walnut wood, and if it can be obtained in sufficient quantities, it will, I am sure, quite bear out what Mr. J. D. Dougall has said of its merits for military rifles.

W. F. WEBB."

"Sir,—I am pleased to observe that my recent letter in your columns has drawn attention to the above subject, which is certainly of national importance. Great changes are being made in small arms, and they are not now the rule, strong, and simple 'Brown Besses' with which our forefathers achieved so many victories. For them the bullets (spherical) were purposely made smaller than the bore to facilitate loading, and were only held in their place in the breech of the gun by the paper of the cartridge. This, as a matter of course, reduced the recoil, but at the expense of accuracy, and it is on record that 200 shots have been experimentally fired at a dummy soldier at 40 yards' range without one bullet striking him. Readers of history may also recollect that on the morning of the battle of Waterloo the barrels of the muskets, which, as usual, had been stacked loaded, had taken in so much water from the heavy rains during the night that the cartridge paper and the gunpowder had been reduced to a wet pulp; consequently, the paper having lost its consistence gave no hold to the screw of the ramrod, and the now useless cartridges could not be withdrawn. It is an historical fact that had not an ingenious sergeant hit upon the plan of swinging the muskets rapidly round, muzzle outward, and so discharging the bullet and cartridge by mere centrifugal force, the consequences might have been disastrous. I give this apparent digression to illustrate the difference between the past and the present, when an elongated bullet has to be driven at an immense velocity through a rifled barrel, the grooving of which bears hardly on it all the way. Consequently there is great strain on the weapon, and every repetition of such strain tells on its general solidity. The recoil is also very great, and I believe it has been stated in the columns of the *Times* that the shock of this recoil has even cracked military walnut stocks at the handle. If magazine rifles come into use, as is pretty certain, and in fitting the magazine the amenity of the stock has to be infringed upon, we shall have a still greater necessity for the toughest possible wood, if we wish to put into the hands of our soldiers the very best weapon extant. Confidence in his weapon is of prime consequence to a combatant: the want of it may produce disastrous consequences to even the bravest of men. The former may lead to victory, the latter to defeat, other things being equal.

"It is gratifying to find my former statements fully corroborated by so good an authority as Mr. W. F. Webb, after practical experience in the trying climate of Africa. It may surprise your general readers to be told that guns are peculiarly affected by climatic influences. All desiccating air acts most tryingly on the stocks and thereby loosens all the fittings, as so correctly described by Mr. Webb, and there are other climates which rapidly injure generally all but the very best materials and sound fitting, of these China having about the worst.

"I may be permitted to state in conclusion that I have not recommended this wood from any selfish motives. My vocation is as distinct from that of a military gun contractor as it well can be. But circumstances, to which my more pointedly referring might be deemed egotistic, have caused me for many years to study the vexed question of modern gunnery in all its branches, and I may at least say that I have never been found a misleading guide, but the contrary. I should also wish to add that this nation is entirely dependent upon foreign countries for an adequate supply of walnut, and what might not this lead to during a protracted war? I have endeavoured to show how we can protect ourselves, and if my advice be not taken by the authorities concerned I shall at least have the satisfaction of having done my duty to my fellow-countrymen.

J. D. DOUGALL."

FELLING AND TRUCKING IN FORESTS.—The felling and transport of timber in forests is in many cases still conducted by inefficient and obsolete appliances, notwithstanding the introduction of several inventions specially designed to remove the difficulties, vexations, and expense inseparable from these primitive methods. In forests which are periodically depleted, and a regular and fair supply of timber produced, felling by steam-power and transport by rail trucks effect an immense saving in labour, despatch, and expense over the hand saw, the axe, and haulage by horse-power. This said, we need make no apology for introducing to the notice of our readers a system for accomplishing these preliminary operations in the "forest primeval," recently brought under our notice by Mr. Arthur Koppel, of Tempelhofer Ufer, Berlin, S. W., the inventor and patentee, who is represented in this country by Messrs. R. Uhlich and Müller, 2, Bury Street, St. Mary Axe, London, E. C.

Our illustration, *Fig.* 1, shows Mr. Koppel's method of working the saw by steam. The saw itself is so inconsiderable in weight that it can easily be carried hither and thither. It can also be wheeled with equal ease by being attached to the axle of a small hand cart. A strong screw, the end of which is

fastened in the tree, and which is connected with the apparatus by a bar, suffices to place the saw ready for action. The rapidity with which this saw works is very great, and in a few minutes an oak or any other hard or soft wood tree of the largest dimensions, is felled to the ground.

Even if we include the time necessary to convey the saw from one tree to another, we find that the saw can fell 40 trees of the largest dimensions in a day of 10 hours length. Experience has proved this, although this admirable machine is of very recent date. Already it is in use in many of the largest forests of Hungary, Slavonia, Roumania, and the Caucasus.

A single steam engine suffices to keep four of these saws in operation at the same time in various directions. The reader may notice the different manipulations which can be effected with this saw.

Fig. 2 shows the employment of Mr. Koppel's rail trucks for the transport of long timber. For this purpose two trucks are always used, and in this manner the narrowest curves can be managed even when the timber is of great length. The logs are kept in position on the trucks by strong chains, which, however, allow them full play in turning corners, &c.

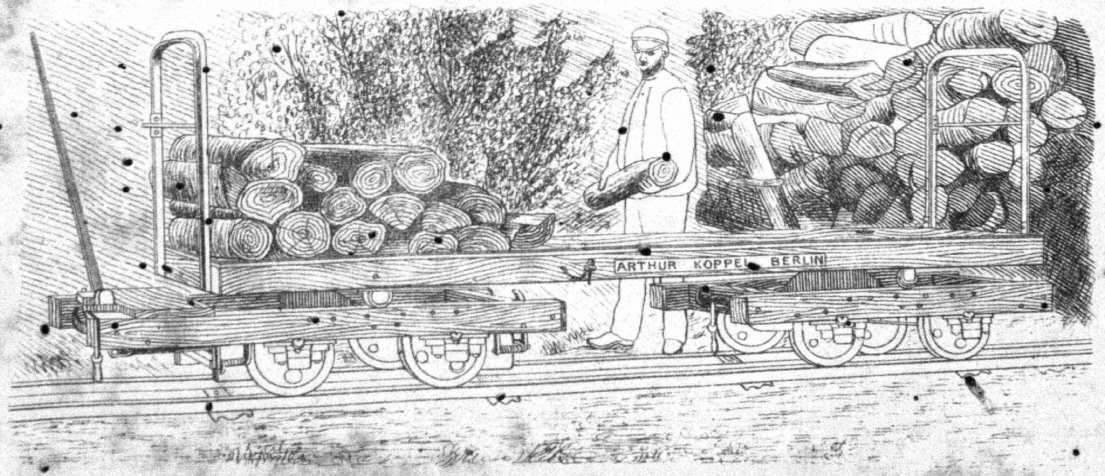
Fig. 3 shows a carriage for the conveyance of log ends, butts, and short trees, which is placed on the two trucks employed for the conveyance of long timber. A bolt passes through the centre of each truck and the carriage or upper framework, which facilitates the turning of the trucks independently of the carriage. Rollers are attached to the lower part of the car, which facilitate the motion of the trucks on the same, and afford additional support to the carriage.—*Timber Trades Journal.*

THE forests of East Tennessee are prolific of ivy, and annually yield thousands of dollars' worth of roots, which are shipped north, to be made into door knobs, bureau knobs, fine veneering, inlaid work, &c. The roots, delivered at the railway stations, are bought by dealers at 11 to 12 dollars per ton. The demand is great, and the supply in the mountains appears to be unlimited.

PROFESSOR Poleck has discovered that timber immersed is no longer liable to the attacks of *Merulius lachrymans* or dry rot fungus. The water dissolves out the albumen and salts, and thus deprives the fungus of the nutriment, needful for its development.—*Transactions of the Institution of Civil Engineers* (Vol. lxxxvi., p. 9).

FELLING AND TRUCKING IN FORESTS.

Fig. 3.



Litho. T. C. Press, Roorkee.

THOS D. BONA, *Supdt.*

THE

INDIAN FORESTER.

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WE congratulate Sir Dietrich Brandis, F.R.S., Ph.D., on his elevation to the rank of Knight Commander of the Indian Empire on the occasion of Her Majesty's Jubilee.

It is an honor which he has well deserved, and of which the Forest Department may be proud. As the heads of other Departments have been selected for decoration on this occasion, we should have been pleased to see the title of C.S.I. or C.I.E. conferred on Dr. Schlich, the present Inspector General of Forests, who is now at Cooper's Hill College, organizing a course of instruction in European Forestry for the Indian and Colonial Forest Service.

THE INDIAN FOREST SERVICE.

WE republish an article on the Indian Forest Service, which appeared in a recent Number of the "Indian Agriculturist," as it is well for us all to know what non-Foresters think of our work, and of the capacity required to manage forests successfully.

"It is announced that an open competition for the Forest service in India, will be held in London in June next, when not less than ten probationers will be selected. The examination will be open to all natural-born subjects of her Majesty, but they must be unmarried, and above 17, but under 21 years of age on the 1st of June, 1887. The subjects of examination form a somewhat wide curriculum of studies, in which the Latin and Greek languages give place to German and French. The service can have no attractions whatever for English youth, and as its conditions become known, it will much surprise us if any applicants whatever, present themselves to the examiners. For if the candidate is successful in the competitive examination, it does not by any means follow, that he will finally secure an appointment to the service. The competition is but the commencement of a series of examinations, recurring periodically, while the probationer is under what is called a course of training at Cooper's Hill College, extending over nearly two years, at an annual charge of £180, to be borne by his parents or guardians. At 22 or 23 years of age, and after an expensive education that cannot have cost his

parents less than £250 a year, from the time he was 14 years old :—if the boy's character is good, his physique strong, his sight and hearing perfect, and he can ride well, he *may* get an appointment in India, to the magnificent position of an Assistant Conservator of Forests on Rs. 250 a month, from the date of his arrival in the country. Particular stress is laid, in the rules for admission, upon the applicant's good vision and hearing. 'Means are taken to test his physical powers of endurance'—we hope not by making him qualify as a 'fasting man,'—and all these formidable preliminaries result in the chance of the young man securing an appointment in the forests and jungles of India, upon the extravagant pay of £170 to £180 a year (Rs. 250), with no prospect before him whatever. He must pass through no less than seven grades of the service, before he becomes a third grade Conservator, upon about £650 a year. It is a mockery and a snare, to parade such a service before English parents, who know little or nothing of the conditions of service in this country. Take the case of an English boy at 15 years of age, whose parents or guardians are prepared to spend £2,000 upon giving him a fair start in life. Under this shameless Cooper's Hill fraud the boy's friends are induced to spend £250 a year, for seven or eight years, upon his education, to procure for him the chance of spending his life in the jungles of India, upon a salary of £180 a year rising to £700. An English boy who has been under good tuition from 9 to 15 years of age, is well fitted to become an apprentice in any profession or business whatever, while if his friends have £2,000 at their command to give him 'a start in life,' they can place him with the greatest ease, in circumstances in which he may secure a junior partnership in the firm that has educated him, at the very same age at which the victimized candidate for a life in the jungles, is offered the magnificent salary of £170 a year. Cooper's Hill is a fraud upon both nations, while it is kept up at indefinite cost to the people of this country, who have already been made to pay well on to half-a-million sterling, for its foundation. It is necessary to speak plainly upon this subject. There is no reason whatever, why the Government should not have a large forest school in India itself, for training native youths for the exclusive filling of these jungle appointments. It may be, and no doubt is, desirable to have two or three highly-qualified men of European training, at the head of every provincial branch of the service, but that exhausts absolutely the need for European officers. And in a very few years' time, even *that* need will disappear, India herself producing a school of Forest officers, second to none in the world. The simple truth is that in the midst of endless protestations of our desire to rule the country wisely, every branch of the public service, upon one pretence or other, is made a preserve for Englishmen. Native youth, including the Eurasian community, are practically excluded, because their friends cannot possibly face the costly regulations, which require them to pass these ordeals in England. What person of common sense fails to see, that however real may have been the necessity for European guidance in the establishment of the Forest service, that need has now gone, and that it is in India itself that we should now recruit the service, without a thought of resorting to England for the purpose. The service has ceased to offer a career to English youth, and it is only to impose upon the mother-country, to keep up the pretence

of such a career for its sons. The schools of this city alone—such Schools as the City College, the Doveton, St. Xavier's, the Missionary schools, and others—are turning out every year, boys in large numbers, for whom all appointments in the Forest, Opium, Police, Land Settlement, Post Office, Telegraph, Railway, and Account Departments, should be reserved. England will still have not only her own home service and colonies, but the highest appointments in India as a legitimate career for her sons, while to train them highly and at the expense of India, for competition in the services that we have named, is a wrong both to the mother-country, and to its great dependency. The only satisfaction we have in reviewing matters, is the inclination of the Government to accept these views, but unless the public press drive the conviction home, the Government will move only with the proverbial slowness that characterizes its action in all reforms."

It will be seen that the writer wishes to secure the posts in the Forest Department entirely for native youths, and complains of the enormous cost of Cooper's Hill being saddled on India, and rates the ability required for "these jungle appointments" at rather a low figure.

It is generally admitted that the proper ground to take as regards the public service, is to secure the very best officers available to carry it on, and if young men of education in England come forward under the present conditions of the Forest service, and their guardians are willing to pay the high cost, at least £500, including outfit, of their training at Cooper's Hill, we fail to see why the "Indian Agriculturist" should complain. Admitting the necessity for the maintenance of the Cooper's Hill College for the Indian Public Works and Telegraph Departments, the fact that certain Forest students are to be trained there as well, at their own expense, tends really to diminish the cost of that institution.

We admit readily that the pay of the higher grades of the Forest Department does not correspond with that of the other Departments in India, and that with the present rate of exchange, the prospects of furlough for married Forest officers is very illusory, indeed furlough is now rarely taken except when an officer is compelled to do so by ill health, or by the necessity of providing education for his children. Pension also is a pittance, which without private means, or almost impossible savings, will not allow for retirement with any prospect of maintaining a family in comfort. In spite of these drawbacks, however, India is to be congratulated on the fact that, the Forest service still presents attractions to many young men of the United Kingdom, who like the wild out-door life in the forests and the freedom from sedentary occupations.

The writer of the paper in the "Indian Agriculturist" considers that highly trained men were required to organize the Forest Department, and that they have done their work so completely that though "a few of them may be still required, at the head of every provincial branch of the service ..?..... yet even

that need will soon disappear," and the service in future should be recruited exclusively in India.

Now it may be conceded that, some of the present Forest divisions do not make much demand on a man's abilities, and that a good capacity for business, coupled with thorough integrity, and industry, and a strong frame and constitution, combined with sound common sense, in themselves qualities not very common in India, will suffice for the successful management of some remote Forest divisions, where the chief work is the maintenance of the forest areas intact, there being as yet little demand for produce. Such charges, however, are becoming rarer every day, with the rising demand for forest produce, whilst Forest divisions, such as those of the N.-W. Provinces and Oudh, where every kind of produce can be sold, require a high standard of professional education, the want of which may lead to mistaken treatment, with the very worst results to the future of the forests.

The popular idea is that, any one can manage forests successfully, and that waifs and strays of humanity, who have failed to obtain admission to other departments, can readily find a field for their exertions in the Forest service, and the "Indian Agriculturist" classes Forestry with a number of departments, which, except Telegraphy, do not require a special scientific training, as one peculiarly suited for men trained exclusively in India. The wisdom of our Government in classing Forestry with Public Works and constructive Telegraphy, and demanding a high preliminary standard of scientific education from men intended for the controlling staff of the Forest Department, is apparent, though it is not clear why the same privileges as regards pension and retirement, which have been accorded to the other departments, should not be extended to us, so that the three departments may be on an equal footing at Cooper's Hill, and the Forest service not merely obtain the residuum of the other competitive services. A sound preliminary scientific training can be afforded by the present arrangements for teaching Forest students at Cooper's Hill, as well as a purely general course of Forestry, but whether Indian Forestry can be better taught there or at Dehra Dún is another question, though the staff at the Dehra Dún Forest School is at present far too weak to undertake the instruction of the controlling staff of the Forest Department.

What the Dehra Dún School is now doing is to train a subordinate staff of Sub-Assistant Conservators and Forest Rangers, and if all the Local Governments and Native States would see that a properly guided and fairly well paid subordinate staff, with salaries ranging from Rs. 50 to 400 were provided wherever the forests are of sufficient importance to be subdivided into ranges, we might expect a competition of fairly educated men from the Indian Schools for these appointments.

Each province should also provide means for the practical

training of Forest Guards and Foresters in their duties, such as—coppicing, and cutting back inferior growth, clearing and pegging out straight lines for roads, surfacing and draining roads, economic burning of fire traces, charcoal making, management of nurseries and plantations, &c., &c., of which many of them are entirely ignorant at present.

After a strong subordinate staff of Forest Rangers has been trained by the Dehra Dún School, and the results of their work has been seen, the question of the training in Forestry of the Controlling Staff in India might be considered, but scientific education in India has not yet afforded any thing like a sufficient supply of properly qualified candidates for Rangerships, and Indian Forestry would be hopelessly thrown back, were the Controlling Staff to be taken from the class of men whom the "Indian Agriculturist" recommends. If only the men sent out from Cooper's Hill have received a thorough preliminary scientific training, we are quite willing that the Controlling Staff should be reduced in numbers to the absolute minimum consistent with efficiency, and by a careful arrangement of divisional forest charges, something may be done with this object in view; but it is probable, especially when we consider the requirements of Upper Burma, that the numbers of the Controlling Staff cannot be reduced below its present strength. Leaving out the important Native States of Mysore, Hyderabad, Baroda and others, where the Chief Forest officer and one or two others at any rate, should be thoroughly scientific Foresters, we consider that the Controlling Staff under the Government of India, besides the Inspector General of Forests, should comprise the following officers with the rank and pay of Conservators.

Assistant Inspector General and Superintendent of Forest Working Plans.

The Superintendent of Forest Surveys.

The Director of the Forest School.

Four assistants are required for the latter officers, who should all be highly trained in Forestry.

For the principal Local Governments, namely Bengal, N.-W. Provinces and Oudh, Punjab, Central Provinces and Lower Burma, there should be a Chief Conservator of Forests, who should be also Forest Secretary to Government, and this would ensure unity in the Forest administration, which the present subdivision of some provinces into several circles will not allow.

Another Conservator should also be added who will assist in inspection, and have special charge of Working Plans, directing the compilation of new ones and seeing that the provisions of accepted ones are carried out.

Two Working Plans officers will also be required for each of these provinces.

In Assam, Berar, and Coorg, only one Conservator, with one Working Plans officer, might suffice.

District Forest officer's charges should be as far as possible conterminous with districts, and the more important Divisions should carry the highest pay, and we should not see the present anomaly of promotion in the Deputy Conservator's grade, simply going by seniority. Smaller Divisions may be held by members of the Executive Staff, and no officer of the Controlling Staff should hold charge of a Division till he has managed an important range successfully. Considering the difficult nature of framing Forest Working Plans, and the absolute necessity of entrusting this work to the most scientific and experienced of the Divisional officers, the Working Plans officers should draw special allowances, in addition to their graded salaries.

They should also be in charge of the maps of the province under the Superintendent of Forest Surveys, but should be otherwise under the Conservator's orders.

The Controlling Staff for the Government of India, including an estimate for Upper Burma, would comprise besides the Inspector General of Forests, 17 Conservators, 14 Working Plans officers, 80 Divisional officers, and 28 Assistants=140 officers, and to these we may add 30 officers for Madras and the same number for Bombay, though we are quite uncertain of the number required for that province, making a total of 200 officers for the Controlling Staff for the whole of India, exclusive of those required for the Chief Native States.

It is quite possible that as the Dehra Dún training tells, and a strong Executive Staff is formed in every province, that this number might be gradually reduced, but allowing for a sufficient number of men to learn their duties in charge of ranges, and to supply the places of officers on leave, it is impossible that the number of the superior Staff can be less than 160, at the very lowest, and the lower its number is fixed, the greater the necessity for obtaining men of the highest attainments for the work, so that the impossibility of the wish of the "Indian Agriculturist" to reduce the Forest Department to a quite subordinate position in India being carried out is plainly shown.

We may remark here that many men come up to the Dehra Dún Forest School to compete for the Executive Staff with the merest smattering of a knowledge of Arithmetic, and that it has been impossible for many of them to profit fully by the instruction at the School, and that the only hope of securing really competent men for the Executive Forest Staff, on which the future of Indian Forestry so greatly depends, is that each Government should thoroughly overhaul its list of appointments, and see that they are properly graded, and the work so distributed as to afford responsible charges and fair prospects of promotion for intelligent young men, who at present, to a large extent, only come to the Forest Department, in default of every other employment.

The sanctioned Executive Staff of the different provinces is at

present as follows, according to the last list of officers under the Government of India:—

Province.	Salary in Rupees.								Total.
	250	200	150	120	100	80 or 75	70 or 60	50	
Bengal, ...	2	2	3	..	...	2	3	14	26
Assam, ..	..	1	2	...	...	1	4	5	13
N.-W. P. and Oudh,	1	2	1	...	1	2	5	7	19
Ajmir, ...	...	...	1	...	...	...	...	1	2
Punjab, ...	...	4	3	1	1	2	3	13	27
Central Provinces, ...	2	3	1	...	3	4	5	10	28
Coorg, ...	...	...	...	...	...	...	1	1	2
Berar, ...	...	1	2	1	...	...	3	5	12
Burma, ...	...	1	4	1	2	3	4	13	28
Total, ...	5	14	17	3	7	14	28	69	157

In Madras we find the following Executive Staff:—

Salary in Rupees.							Total.
200.	150.	125.	100.	80.	60.	50.	
7	6	2	4	10	12	15	56

This contrasts most favorably with that of the Government of India, where nearly half the appointments are on Rs. 50, and there is in several Provinces very little chance of promotion for years to come to promising men trained at the Dehra Dún School.

We regret that we cannot give the list of appointments sanctioned in Bombay, but hope that one of our friends there will furnish it for our next Number.

What is required for each Province in India is a re-classification of all forest divisions and ranges, in the most careful way, so that class of work may be commensurate with the pay of the post throughout India, and the Forest service will then present as fine a field for a man's energies and for the study of Biology as can be desired.

TABASHEER.

I WISH, through the medium of the "Indian Forester," to draw the attention of my friends and former colleagues, as well as of

younger Forest officers in India generally, to this remarkable substance, because the study of its formation may possibly lead to important results concerning the life history of the large bamboos, in the hollow joints of which it is deposited. Its great, and I may add unmerited, fame as a medicine, this substance has received mainly through the writings of the old Arab physicians, particularly of *Razi* + 923, and of *Ibn Sina* (better known as *Avicenna*) + 1,037. But the name is of Sanskrit origin *tvakkshira*, *tavakkshira*, meaning milk in the skin.

The oldest detailed account of this substance known to me, is contained in a letter from Dr. Patrick Russell to Sir Joseph Banks, dated Vizagapatam, November 26th, 1788, printed in Vol. 80 (1790) of the Philosophical Transactions of London. He notices the erroneous account given by Arab writers of its origin through the burning of bamboo stems, especially of such as have suffered from fire kindled by the friction of the reeds one against the other, an accident, he adds, supposed to happen frequently in the dry season among the hills, and he mentions that in the Latin versions of Razi and Avicenna, tabasheer is constantly but erroneously rendered by *spodium* (ashes). He adds, that the mountaineers, referring probably to those of the Vizagapatam district, say, they never look for tabasheer in the half burnt fragments of the bamboo. Here I may mention at the outset, that the erroneous notion, that tabasheer is obtained from the ashes of bamboos, is still current in books in Europe. Tabasheer was also formerly confused with sugar, this error, however, was cleared up by Rumphius (Herbarium Amboinense, IV., 11). He says that the *sugarcane* has been confused with the bamboo and *sugar* with tabaxir, also called Sachar Mamboe. Rumphius wrote his large and excellent work about 1690, and it was published in 1750. Colonel Yule, in his delightful book "A Glossary of Anglo-Indian words (1886) enters fully into this interesting question, and shows the absurdity of the idea, which has long been entertained, that the *saccharon* of Greek and Roman writers was not sugar but the siliceous concretion sometimes deposited in bamboos (pages 654 and 675).

The account of Dr. Russell's own researches forms the most interesting portion of the papers. After mentioning, that tabasheer is only found in the joints of the female bamboo (in this case probably *Bambusa arundinacea*), he explains that on shaking the bamboo, a rattling noise indicates the existence of tabasheer in large pieces, and that these are bluish white, like fragments of shells, but softer in substance. In other cases there is only a rough friable white or cinereous powdery substance adhering to the inner wall of the joint.

In April he examined a bamboo of six joints received from Vellore (probably the place on the Palar river west of Madras is meant). On splitting it, no vestige was found in two joints, these were discolored within. The whole quantity collected

amounted to 27 grains, and the largest quantity was obtained from the two middle joints. A small portion, about four grains, consisted of bluish white solid pieces, but soft, the rest was cinereous and friable.

In July, 37 bamboos were split out of a large quantity of green bamboos, each containing 5-6 joints, which had been brought from the hills 50 miles distant from Vizagapatam. In nine of these no vestige of tabasheer was found, the remaining 28 yielded small quantities, in the aggregate not much exceeding 2 drams ($54\frac{9}{8}$ grains). The substance was never found in more than three joints of the same bamboo, and the empty joints were sometimes contiguous, sometimes interrupted. The white smoother and harder particles adhered to the septum and to the sides at the ends, never to the middle. Instead of being chiefly found at the lower extremity of the joint, as might be expected from the sap settling there, they were found adhering indifferently to either extremity, and sometimes to both, forming a smooth lining, somewhat resembling polished stucco, generally cracked in several places, which could readily be detached with a blunt knife. In some joints the tabasheer was thus collected at one or both extremities only, and in such no rattling was perceived, but generally, while some adhered to the extremities of the joint on the inside, other detached pieces were intermixed with the coarser loose particles in the cavity.

Tabasheer has been repeatedly analysed. In one point all analyses agree, that it chiefly consists of silica, the proportion varying between 70 and 90 per cent., with a small quantity of moisture and organic matter. The other principal substances are lime and potash, but their proportions seem to vary. (See Turner's Analysis of Tabasheer, Edinburgh Journal of Science, XVI., 335, and T. Thomson, quoted on page 257 of the Pharmacopœia of India). The silica, lime and potash were doubtless originally held in solution in the sap, which is taken up by the roots from the ground. The sap which fills the cells of the growing bamboo-shoot, holds these inorganic substances in solution, together with sugar, gum and other organic substances which have been elaborated by the action of the leaves. As the shoot grows older, cavities are formed in the joints, and in these cavities some of the sap collects from the surrounding tissues. The existence of this watery fluid in the hollow joints of the bamboo is well known to all who have spent some time in the bamboo forests of India and other tropical countries.

There is little doubt, that tabasheer is the residue of this fluid, but it is not clear how it is formed. In any case, however, the fluid in the hollow joints is intimately connected with tabasheer, this seems also to have been Dr. Russell's view of the process, and accordingly he paid attention to the fluid found in the joints of the bamboo. The existence of such fluid, he observes, may be known by the sound when the joint is shaken. He

never found fluid in more than two joints of one stem, and never in large quantities, 1½ ounces being the largest amount obtained from one stem. He adds that the fluid always had a slightly saline and astringent taste, that it was always transparent but varied in color and consistency. Some of a darker color had the consistency of honey, some on the other hand was perfectly colorless but nearly dry. Both kinds, he says, had the sharp salt taste of fresh tabasheer.

Dr. P. Russell also mentions, that in the bazars of Hyderabad two sorts of tabasheer are sold, the best at one rupee a dram, the inferior kind at half that price, the latter consisting chiefly of burnt teeth and bones. A Parsee informed him, that tabasheer was produced in great quantities in Sylhet, and sold there at Rs. 1 to 1-8 per pound, also that it formed a considerable article of trade from Bengal to Persia and Arabia.

A later volume of the Philosophical Transactions (for 1819), contains an important article by Sir D. Brewster on the very remarkable optical and physical properties of tabasheer. In that article Brewster mentions also, that Humboldt discovered tabasheer in the bamboos which grow to the west of the *Pinchincha* in South America.

About 10 years later Sir David Brewster published in No. XVI. of the Edinburgh Journal of Science, additional observations on the natural history of tabasheer, together with some remarks on the subject by Dr. Wilson, at that time Secretary of the Asiatic Society, Calcutta, who speaks of it under the Bengali name *bans lochan*. In the Calcutta market, Dr. Wilson says, three sorts are sold. The best is called Patnai, because it is brought from Patna, small solid pieces of milky white color and half transparent. This kind is also called Nilkanthi on account of its bluish color, and Paharika, because it is brought from the hilly country west of the Ganges. The second sort is white, dull and friable; neither shining nor transparent; it is called Chhelata, and is supposed to be brought from Sylhet. The third and least valuable kind is called Desi. Regarding the first kind (Paharika) Dr. Playfair at Hazaribagh wrote to Dr. Wilson that it was obtained from the hilly country of Chutia Nagpore, 6–100 miles from Hazaribagh, and from Palamow. "It is found in the small hill bamboo, under which I suppose we must understand *Dendrocalamus strictus*, and out of 50 or 60 plants only five or six yield it. A stem contains as a rule 4-5 grains, and very rarely it happens that 40-50 grains are found. The same stem often yields the three kinds, the best, which is shining and bluish white, the second sort white, like chalk, not shining, and the third brown and sometimes even black. The raw material sells at the rate of 10 Rupees a seer, but after it has been prepared for use, the same quantity costs 40-50 Rupees. This preparation consists in heating it in a crucible of clay and maintaining it at red heat for some time. When heated the *bans lochan* at first

becomes black (by the carbonization of the organic matter which it contains, but after the organic matter has been completely consumed, the substance becomes white again after cooling. One-and-a-half ounces of the natural tabasheer treated in this manner, yield one ounce of the prepared substance.

Sir David Brewster expresses a remarkable view regarding the formation of tabasheer. He thinks that it must be the result of a disease in the bamboo of a disorganized state in the transverse walls, which separate the joints. He adverts to the statement made by an intelligent native of Vizagapatam, that the walls of these joints which contained tabasheer are always perforated by holes made by an insect, but adds correctly that tabasheer is often found in joints which have no such holes.

The conclusion to which he had arrived, seems to be that the sap is collected in the transverse wall which separates the joints, and that when the tissue of this wall gets diseased, or when the membrane which clothes the inside of the joint is injured, the sap which holds the silica in solution, filters through into the joint, and on drying up leaves the tabasheer.

The remainder of the paper is devoted to an account of the remarkable physical qualities of this substance, which it would lead too far to reproduce here.

The editors of the German Periodical, in which the translation of Brewster's papers is published* (Journal für Chemie und Physik, Vol. 52, 1828) add some further information regarding tabasheer. A green bamboo, grown in a conservatory near London, was found to contain a small hard round pebble in one of its joints, of a dark blackish brown color. Again it has been reported by Dr. Moore (Edinburgh Journal of Science, IV., 192) that concretions similar to tabasheer were found in the nodes of a large kind of grass which grows between "Nagpore and the Circars."

These are the most detailed researches published, and I will now give a brief account of the statements made by other authors on the subject of tabasheer.

Rheade (Hortus Indicus Malabaricus, Vol. I., 25) merely says: "stipites hujus arboris (*Ily, Bambusa arundinacea*) cum vetustiores sunt; aliquo genere calcis in cavitate obducuntur, quae usui medico servatur."

Rumphius, Herbarium Amboinense, Vol. IV., 10, mentions that the younger stems of bamboos contain in their lower joints a colorless fluid fit for drinking, and that in other countries, particularly in some provinces of India proper (in quibusdam Indiæ veteris provinciis) it leaves a white substance similar to lime, which is called *tabaxir*. In the Indian Archipelago he distinctly says that this substance is not found in the joints of

* The extracts here given are taken from the translation as I had not the original here to refer to.

bamboos, and adds that in one place only (in Hituae ora) a similar substance was once brought to him by his servants.

Mason (Burma, 1860, 503) merely says that some of the bamboos of Burma secrete a silicious substance, called tabasheer, which has a place among native medicinal substances: he adds the Burmese name, which means stone out of the bamboo. In the new edition published by Mr. Theobald (1883), the latter states (Vol. II., p. 102) that the fluid, which is contained in the joints of bamboos "is often limpid and a grateful drink when no other water is procurable in the forest, but as it dries up it becomes milky, and finally deposits a cake of gelatinous opaline silica at the bottom of the joint, known as *tabasheer*, possessing curious optical properties." He adds: "these little discs of *tabasheer* may often be picked up in a bamboo forest, after the bamboo which yielded it has decayed; and when a bamboo forest has been destroyed by fire, these white calcined discs form quite a noticeable feature of the ground, especially when a shower of rain has removed the white pulverulent ash."

The late Sulpiz Kurz in the excellent paper, which he communicated to the first volume of the "Indian Forester," mentions the water in the bamboo joints, which often quenched his thirst during his tours in the Java hills, and he adds that "tabasheer is a siliceous whitish floury substance, which is found as a secretion, or more probably as a residuum in the interior of the joints of several species (especially *Bambusa arundinacea*) often up to an inch in thickness," (page 239).

During my forest wanderings in India, particularly in Burma, I have often seen the fluid contained in the joints of bamboos, and have drunk it. In those days I endeavoured to ascertain more particularly the conditions under which sap is found in the cavities of the joints, but did not come to any definite result. I have seen the deposit of silica on the inside walls of the joints, but never in such large quantities as mentioned by Kurz, nor do I remember having seen the discs of tabasheer described by Mr. Theobald. But I must add, that, during my Indian career I never found time for continued scientific research. The difficulties of first organization were too great, and the battle against those, who opposed forest conservancy, was too severe in those days to leave me any leisure for systematic study. The Foresters of the present day are in a much more favorable position, and hence I venture to hope that the present remarks may induce some of them, to study this subject on the spot in the forest.

So much is known for certain, that tabasheer is found in Sylhet (probably also in Assam), in Chutia Nagpur, in Burma and in the Peninsula, both on the east, as well as on the west side. Indeed I am disposed to think that it is formed in the joints of all large bamboos, at least in the Tropics. From what Rumphius says, one might doubt the formation of it in the

extensive bamboo forests of the Indian Archipelago. But Kurz, when speaking of tabasheer in the passage quoted above, probably referred to his previous experience in the Archipelago, and I am disposed to think that Rumphius, though an excellent observer generally, may possibly, in this particular instance, have been mistaken. In a Dutch scientific periodical ("Tijdschrift voor natuurlijke geschiedenis en Physiologie," 1836, p. 13) I find the following notice in a letter from Dr. Korthals, written at Padang (Sumatra) in February 1835. "In the stems of several bamboos a considerable quantity of water is found. This water, which is mostly 4—6 degrees Centigrade below the mean temperature of the air, seems to contribute towards the formation of the gelatinous siliceous substance, which sometimes occurs in the bamboos and is precipitated out of that fluid." It does not, however, follow from this passage, that tabasheer was found by Dr. Korthals in Sumatra.

These are the main data, which I have been able to gather upon this subject. Before explaining my suggestions regarding the researches which I venture to hope will be undertaken in the bamboo forests of India and Burma, it may be useful briefly to sketch the ideas which I have formed at present regarding the formation of tabasheer in the living bamboo stem.

When the young bamboo shoots first make their appearance, they consist of a continuous mass of soft fleshy tissue. Only gradually, as the internodes lengthen out and the joints become visible, hollows are formed in the joints. At that time the shoots have no side branches, they generally bear only a few leaves of the ordinary kind at the end of the stems, and in this state the substance of the joints is soft. This is the stage at which the wood fibres can readily be separated and made into paper stuff. Towards the end of the first rainy season however, the development of lateral branches commences, and at the same time the joints become hard by lignification and by the deposit of silica in the cells and fibres near the outer surface of the stem. After this process of induration has progressed to a certain point, the separation of the wood fibres becomes difficult, and at that more advanced stage the bamboo stems can no longer be used for the manufacture of paper stuff.

The silica which is used in the process of induration, is taken up from the soil by the roots, and the sap which fills the vessels, fibres and cells of young bamboo stems, must, therefore, at the time, that the process of induration has commenced, hold silica in solution, possibly in combination with other substances. Evaporation goes on at a great rate through the leaves, the sheaths and the surface of the internodes, while, under the influence of the light, the carbonic acid taken up from the air, together with the water, nitrogen and mineral salts taken up by the roots, are transformed into the substances forming the tissue of the growing stem. The silica gradually accumulates, and the result of

this accumulation is the induration of the outer portion of the stem. The process is analogous to the accumulation of lime in old leaves, to which I drew attention in the "Indian Forester" of February 1886 (p. 58), with this difference, that the leaves of *Pinus Laricio*, to which my remarks at that time related, take three years to increase the proportion of lime in their ash from 15 to 70 per cent., whereas in the bamboo stems the accumulation of silica is accomplished in a few months.

Some of the sap, with which the cells of the tissue are filled, collects in the cavities of the joints, and as already stated, the tabasheer is produced from this fluid, though the manner in which it is formed is by no means clear. Tabasheer contains from 70 to 90 per cent. of silica, and only from 10 to 30 per cent. of other substances, including moisture. It is probable, that the living sap in the tissue of the bamboo stem *contains a much larger* proportion of other substances. Tabasheer cannot, therefore, be regarded simply as the residue of the substances held in solution by the sap. Again, it is not clear how the water of the sap is got rid of. When insects have tapped the joints and have perforated the walls, the sap contained in the hollows evaporates rapidly, and such joints are always I believe dry. Some evaporation may, perhaps, take place through the walls of joints in a sound condition, but I doubt whether that is sufficient to account for the formation of tabasheer. Apparently a process of secretion takes place, which has some analogy to the secretion of resinous substances and to the formation of crystals of calcium oxalate and other substances in the living tissue.

So much is certain that the subject requires further study, and that such study may lead to important results regarding the life history of the bamboo. The enquiry should bear, both upon the fluid in the joints and upon the tabasheer. In all cases it will be necessary to note the species of which any stems have been examined, the systematic as well as the vernacular name, and in case the former should not be known with certainty, specimens for identification should be collected, of the large sheaths upon the young shoots, of leaves, and whenever possible, of flowers. Soil, elevation and other circumstances, which may have influenced the growth of the bamboo should also be noted.

As mentioned already, young shoots are solid, that is to say, they are entirely filled with soft tissue, and the hollow of the joint only forms gradually, as the stem grows older. It will be interesting to study the formation of this cavity in different species and under different circumstances. At first I suppose the cavity is entirely filled with sap. Gradually the sap disappears in some joints, and endeavours should be made to determine which joints remain filled with sap, and for how long. It will be useful to measure the capacity of the joint, which can

be done with sufficient accuracy by measuring length and diameter of the cavity, and the quantity of fluid contained in it should be determined by means of a graduated cylinder. The quantity of solid matter held in solution in the fluid should be ascertained by evaporation. As far as I remember, the fluid in the joints is tasteless, but a sharp saline and astringent taste has been ascribed to it by some authors. This uncertainty should be set at rest, it should further be determined, whether the reaction is acid or alkaline, and whether in the joints of older stems the fluid gets gradually thicker and assumes the consistency of honey.

As regards the tabasheer itself, it would be important to ascertain, in which species it is found, and particularly whether it is really found in the smaller kinds also, such as *Dendrocalamus strictus*. Further, in which joints it occurs. The precise manner of its occurence, either in the substance of the tissue or as a lining of the cavity, or in loose pieces in the hollow joints should be described in detail, and it would be well to ascertain further particulars regarding the discs of tabasheer mentioned by Mr. Theobald.

I do not know, whether tabasheer is still collected any where on a large scale in India. Should this be the case, it would be interesting to learn particulars regarding the method employed in collecting it, the quantities obtained per stem, its further preparation by calcination or otherwise, the price at which it is sold, and the quantity exported.

Professor Ferdinand Cohn at Breslau, who is well known by his researches in different branches of anatomy and physiology of plants, is specially interested in tabasheer, and would be glad to receive communications on the subject. It might also be useful to send him samples of the tabasheer collected, and of the substances held in solution in the fluid and obtained by evaporation. I shall myself be glad, if desired, to aid in these researches by ascertaining the correct systematic name of bamboos, of which specimens may be sent me, or otherwise.

In conclusion, I may add, that a complete list of the names of tabasheer in the different Indian languages will be found on page 65 of Moodeen Sheriff's Supplement to the Pharmacopœia of India, Madras 1869.

BONN,
December 1886.

D. BRANDIS.

GRAZING IN FORESTS TREATED ON THE JARDINAGE SYSTEM (SELECTION FELLINGS).

YOUR correspondent's letter which appeared in the December number of the "Forester" asks for a solution of one of the most difficult problems in Indian forestry, *viz.*, how to ar-

range for cattle grazing in forests treated on the jardinage system.

As far as the welfare of the forest is concerned, it is a fact generally admitted that cattle grazing should not be allowed in a forest treated on the jardinage system, and the reason for this is not far to seek. We have only to bear in mind the condition and distribution of the growing stock of a *forêt jardinee*, or "forest treated on the system of selection fellings," which is represented by a collection of trees of all ages intermingled over the whole forest. The best example we have of what *forêt jardinee* should be, is a virgin forest where fires, cattle and the axe have never entered. Such examples are not rare in the case of sholas or masses of evergreen forest, many of which can still be seen on the higher ranges of hills in the Madras Presidency and I presume elsewhere, and here it is we can study the natural *forêt jardinee*. The leaf-cover (*massif*) is continuous, trees of every age are intermingled over the whole forest, there is no grass and but little undergrowth, and when one of the old veterans falls down, a younger tree soon takes its place and fills up the gap.

Virgin deciduous forest.—Such examples, however, in the case of deciduous forest are much less common, as a rule their accessibility renders them an easy prey to their three enemies, man, fire and cattle. The only virgin deciduous forest I have seen is situated in an inaccessible portion of the Anamalai Hills. Its condition, however, is practically the same as that of virgin evergreen forest, and there is but little grass or scrubby undergrowth.

In framing a working plan for such a forest we must follow nature's teaching, so long as we fell only the mature trees, and make proper arrangements for keeping out fire and cattle the forest will be maintained in its natural state, with the sole exception that we shall not allow trees to attain a greater age or diameter than that required by the *exploitabilité* prescribed by the working plan. Our object will generally be to grow trees of a diameter most useful to the consuming public. In framing a working plan for such a forest cattle grazing should be prohibited, as the cattle finding but little grass would naturally turn their attention to the young seedlings.

Forests not in a state of continuous leaf cover ("*massif complet*").—We next come to the forests which are not in a state of "continuous cover" (*massif*), these are unfortunately the most common in this Presidency, and tax the skill and ingenuity of the Forester to improve them. They may be grouped as follows :—

(*a*). Forests growing on the slopes of hills.
(*b*). Forests growing on plains or plateau.

(*a*). *Forests growing on the slopes of hills.*—In such forests the growth is, as a rule, poor, and the more the forest is opened the

poorer it becomes, as the humus and soil get washed away. In framing working plans for such forests, cattle grazing should be prohibited, as grass and shrubs are the most valuable auxiliary we have in protecting the young seedlings, and in disintegrating the rock, and so forming soil. Further, on hill slopes cattle loosen the soil, which is washed down when the rains begin.

(*b*). *Deciduous forests growing on plains or plateau.*—When such forests are much opened a rank growth of grass, shrubs and thorny creepers at once springs up, and is a source of great danger, as it chokes the seedlings, and unless the most stringent precautions are taken, fire is sure to enter. It has been asserted that in such a forest, cattle are most beneficial in aiding natural reproduction. That they eat and trample down the grass cannot be denied, but that they also trample down and bite off the tops of the seedlings must in common justice also be admitted. How then to get rid of the grass? A correspondent in one of your former Numbers, stated that in forests properly protected from fire, the grass after a time falls down and dies. At the time I was rather sceptical about the truth of this statement, as I had in my mind's eye a forest, which had been protected from fire, and cattle excluded for four consecutive years, and the grass showed no signs of dying out. The fifth year is now nearly completed, and the Forester in charge of the forest reports that the grass is dying and that seedlings are everywhere coming up.

There is no doubt that grazing in forests of this nature, is less injurious than in those situated on the slopes of hills. But the damage done in any case is only a question of degree, and the advocates of cattle grazing, who state that it is most beneficial in aiding natural reproduction, have deduced their theory from an imperfect study of what really happens. Unfortunately the theory instead of being taken for what it is worth, has been accepted by those who wish for an easy solution of the difficulty of how to satisfy the demands of the cattle owner, and at the same time to preserve and improve the forests.

Far better would it be to face the truth, and to admit that cattle grazing is invariably more or less injurious to the forest, than to accept an erroneous theory as an easy method of getting over a difficulty.

The above is a brief survey of the case from a Forester's situation. But, in cases where grazing rights have been admitted, and where such rights have not been commuted, we must make the best arrangements we can, and the following plan might be adopted. Take, for example, the case of a mixed forest of teak (*Tectona grandis*), rosewood (*Dalbergia latifolia*), vengai (*Pterocarpus Marsupium*), terminalias, &c., and let us suppose that a rotation of 120 years has been adopted and divided into four periods each of 30 years' duration. The trees should then

be divided into four classes, the first class containing trees which are now of a marketable size, say 2 feet diameter and above, the classes will then be arranged as follow :—

1st class,	2 feet diameter and above	to be felled during				1st period.
2nd „	1½ to 2 feet diameter	to be felled during				2nd „
3rd „	1 to 1½ feet	„	„	„		3rd „
4th „	under 1 foot	„	„	„		4th „

The rotation of 120 years has been adopted on the supposition that it will take a teak tree on an average 120 years to attain a diameter of 2 feet.

After making a valuation survey of the forest either by counting and measuring each tree, or else by means of linear valuation surveys, the trees will be arranged in their proper classes. The first class trees will be felled during the 1st period, the second class trees during the 2nd period, and so on. It will be necessary to deduct a certain proportion from the number of 2nd, 3rd and 4th class trees, as it cannot be expected that under the most favourable circumstances they will all come to maturity.

If the number of 1st class trees be divided by 30, the capability of the forest during the 1st period will be determined.

We will suppose the number of 1st class teak trees to be 9,000, the annual yield will, during the 1st period, be 300 teak trees.

The forest may then be divided into 30 coupes, in such a way that each coupe contains approximately 300 1st class teak trees.

As the forest is a mixed one it cannot of course be arranged that the coupe, the limits of which have been selected, so as to contain the required number of teak trees, will contain the exact number of jungle wood trees determined when calculating the capability. If the required number is found in the coupe so much the better. But it must be laid down in the prescriptions of the working plan—

(*a*). That the limits of the coupe are never to be exceeded.

(*b*). That no tree under 2 feet diameter is to be felled.

(*c*). That in cases where the number of 1st class trees (in a coupe) exceeds the capability, the number determined when calculating the capability must not be exceeded.

The coupe should be closed against grazing for two years before, and eight years after, the felling, as cattle on level ground trample down the soil and render it ill-adapted to the reception of seeds. If the coupe be closed for eight years after felling, and precautions taken to keep down the growth of thorny creepers, a certain number of seedlings will have a chance of coming up and attaining a fair size before cattle are again allowed to enter.

When the forest has once got into working order, it will be observed that each coupe is closed for 10 years of the period and

opened for 20. Two-thirds of the whole forest will thus be open for grazing.

The above is only a rough outline, and it may be necessary to shorten the periods if local conditions demand it.

I do not consider it a satisfactory solution of the difficulty, as a large proportion of seedlings must be destroyed by the cattle. If, however, local conditions necessitate the jardinage system, and cattle grazing has to be provided for, I can see no other way out of the difficulty. But I am inclined to think, that except in forests situated on steep hill slopes, where cattle grazing must in time, no matter what system be adopted, cause denudation, the best system to adopt would be either the *mode des e'claircies* or *taillis sous futaie* (coppice with standards). But it should be clearly understood that grazing is not essential to the well-being or improvement of the forest; unfortunately its existence is often a necessary evil, and when such is the case the working scheme must provide for it.

January 14th, 1887. "MASSIF COMPLET."

LIST OF TREES IN THE MELGHAT FORESTS.

THE following will interest some of your readers I hope; being the names of some of the trees in Berár. The names in the Melghát of Berár often differ from those elsewhere in Berár, and after those which I know only as Melghát names, I have placed an M., and B. and M., where the Berár and Melghát names agree:—

Saccopetalum tomentosum,	... Hum-Humba, M.
Dillenia pentagyna,	... Suaruk, M.
Cratœva religiosa,	... Barmál, M.
Cochlospermum Gossypium,	... Ganér, B. and M., Chaor, M.
Flacourtia Ramontchi,	... Gurgúti, M.
Kydia calycina,	... Bothi, M.
Bombax Malabaricum,	... Semal, B. and M., Sáodi, M.
Sterculia urens,	... Karái, M., Teklej, M.
„ villosa,	... Kuthída, Kudal, M.
Helicteres Isora,	... Morarphal, B. and M., Korajbothi, M.
Eriolæna Hookeriana,	... Arang, M.
Grewia tiliæfolia,	... Dháman, B. and M.
Feronia elephantum,	... Kabít, B. and M.
Ægle Marmelos,	... Bel, B. and M.
Ailanthus excelsa,	... Márup, B. and M.
Balanites Roxburghii,	... Hingan, B.
Boswellia serrata,	... Sálai, B. and M.

(I saw this in full flower in the Kinwat forest in south-east

Berár in January, 1886, and in flower in the Melghát in January, 1887. *See* Brandis, page 62).

Garuga pinnata,	... Kekda, M.
Melia indica,	... Ním, B. and M.
„ Azedarach,	... Bakain, B. and M.
Soymida febrifuga,	... Rohin, M.
Cedrela Toona,	... Goriya Ním, M.
Chloroxylon Swietenia,	... Bera, B. and M.
Celastrus senegalensis,	... Bekal, B. and M.
„ paniculata,	... Pingual, M.
Elæodendron Roxburghii,	... Jamrassi, B. and M., Niru, M.
Zizyphus Jujuba,	... Bher, B. and M., Boray, M.
„ rugosa,	... Chŭrni, M.
„ xylopyra,	... Katber, B., Ghóta M.
Schleichera trijuga,	... Kusam, B. and M., Báru, M.
Odina Wodier,	... Mohin, M., Moyna, B.
Semecarpus anacardium,	... Bhiláwa, B. and M., Choso, M.
Mangifera indica,	... Am, B., Amb, M.
Buchanania latifolia,	... Char, Chironji, B. & M. Tárop, M.
Spondias mangifera,	... Kàtamba, M.
Indigofera (sp.),	... Bilúri, B. and M.
Sesbania ægyptiaca,	... Shewari, B.
Erythrina indica,	... Pángra, B. and M.
„ suberosa,	... Nangtháda, M.
Butea frondosa,	... Palás, B. and M., Parsa, M.
„ superba,	... Túnáng, M.
Ougeinia dalbergioides,	... Tewas, B. and M., Rúthú, M.
Dalbergia latifolia,	... Sissu, B. and M.
„ paniculata,	... Passi, B. and M.
Pterocarpus Marsupium,	... Beula, Ragatroru, B., Bija Sál, B. and M.
Pongamia glabra,	... Kurani, B. and M.
Cæsalpinia sepiaria,	... Wál, B.
Bauhinia purpurea,	.. Koilári, B. and M.
„ racemosa,	... Apti, B., Bossái, M.
„ variegata,	... Kachnár, B. and M., Champa, M.
„ vahlii,	... Maulwa, Maul, M.
Hardwickia binata,	... Anjan, B.
Tamarindus indica,	... Imli, B. and M., Chichá, M.
Cassia Fistula,	... Amaltás, B. and M., Bánákábhúngru, M.
Cassia auriculata,	... Tarwas, B.
„ Tarota,	... Tarota, B.
Prosopis spicigera,	... Saunder, B.
Albizzia odoratissima,	... Chichwa, B. and M.
„ procera,	... Kíní, B. and M.
„ Lebbek,	... Siris, B. and M.
Acacia arabica,	... Babul, B.

Acacia leucophlœa,	... Hewar, B. and M., Rinjra, M.
„ Catechu,	... Khair, B. and M.
„ ferruginea,	... Son babul, B.
Terminalia bellerica,	... Behéra, B. and M.
„ Chebula,	... Hilda, B. and M.
„ Arjuna,	... Arjun, B., Kahú, Kowa, B. & M.
„ tomentosa,	... Ain, Sáj, Sáddra, B. and M.; Athna, M.
Anogeissus latifolia,	... Dhaura, B. and M.
Eugenia Jambolana,	... Jamun, B. and M., Jámbu, M.
Careya arborea,	... Kumbi, B. and M.
Woodfordia floribunda,	... Douri, Dhing, M.
Lagerstrœmia parviflora,	... Lendia, B. and M., Chekrej, M.
Casearia tomentosa,	... Késa, M.
„ graveolens,	... Rawít, M.
Anthocephalus Cadamba,	... Kaddam, B.
Stephegyne parvifolia,	... Kaddam, B. and M., Kuram, M.
Adina cordifolia,	... Haldu, B. and M.
Hymenodictyon excelsum,	... Bhorsál, M.
Gardenia turgida,	... Pendra, M.
Randia uliginosa,	... Púrputá, M.
„ dumetorum,	... Ghétu, M.
Embelia ribes,	... Baringeli, M.
Bassia latifolia,	... Mowa, B. and M.
Mimusops indica,	... Khirni, B.
„ Elengi,	... Mulsári, B.
Diospyros Melanoxylon,	... Tendu, Temru, B. and M.
Schrebera swietenioides,	... Moka, B. and M., Jháw, M.
Wrightia tinctoria,	... Kúrá, M.
Holarrhena antidysenterica,	... Dudhi, B. & M., Kúrákatto, M.
Cordia Myxa,	... Gondhan, B., Chílu, M.
„ McLeodii,	... Laurikasmar, M.
„ Rothii,	... Gondhan, M.
Calosanthes indica,	... Phalgatétú, M.
Spathodea xylocarpa,	... Tetu, B. and M.
„ falcata,	... Mersing, M.
Stereospermum suaveolens,	... Padár, B. and M.
Tectona grandis,	... Sígwan, B. and M., Sípna, M.
Gmelina arborea,	... Siwan, B. and M., Kásmár, M.
Vitex Negundo,	... Samálu, B. and M., Nirgudi, M.
Ficus bengalensis,	... Bar, B. and M., Wadá, M.
„ religiosa,	... Pipri, M., Pipal, B.
„ infectoria,	... Páhkar, M.
„ glomerata,	... Gular, B. and M., Láwá, M.
Ulmus integrifolia,	... Chilár, M., Káránjalam, M.
Mallotus philippinensis,	... Kúkú, M.
Briedelia retusa,	... Karkha, M.
Lebidicropsis orbicularis,	... Ghara, B.
Phyllanthus emblica,	... Aonla, B. and M.

Dendrocalamus strictus, ... Bhans, B. and M., Mát, M.

In my Working Plan for a portion of the Beiraghar Forest I called Padar, S. chelonoides. It is S. suaveolens.

February 1887. G. J. VAN SOMEREN.

FUTURE ORGANIZATION OF THE FOREST DEPARTMENT.

I AM very glad to see that "Veteran" has followed the lead of "G. J. v S." in ventilating this subject, particularly as they adopt so admirably cool and contained a tone, the only one which can perhaps benefit a despised, because powerless, minority. I should long ago have addressed you on this subject, but that I felt it would be unwise and unsafe to publish abroad my feelings at being branded (in the matter of leave and pension) as inferior to the Public Works and the Telegraph Departments. There is I think a very general feeling that had we been numerically and influentially equal to those Departments, we should not have been left out in the cold. To get this injury cancelled must be the first step.

Of course there must be in Bombay a Head of the Department, or Secretary for Forests. There would have been one long ago, but that we have all along been, and are still, looked upon with jealousy as interlopers by Revenue officials in general. This jealousy is occasionally very painful and ruinous. I have known in the Bombay Presidency large areas of prospective forest, after Sir Richard Temple's time, simply *swept*, because the people knew they had the sympathies of the subordinate Magistrates (revenue officials also) and of the Collector and his Assistants, unchecked by the superior Government. But in an adjoining taluka, even an Assistant Collector with a true appreciation of the value of forests had no difficulty in preserving them.

I am glad to see that, at last, officious Forest Settlement Officers, with whom I have had trouble in this respect, have been clearly informed that their duties are confined to settling the legal aspects of the case. Being all Revenue officers in disguise, more or less antagonistic to forests, there was an inveterate tendency to gain popularity for themselves at our expense.

I do not quite agree, though the difference is perhaps one of terms only, that working plans, settlements and grazing should be arranged from the *general*, and not the *professional*, standpoint.

Public opinion is no doubt a great thing, so is any other brute force, if only it is big enough. But I hold that these matters should be fixed, sanctioned, and legally bound fast so as to secure their respective full shares to each term of the State,

present and future; and that then, and only then, the convenience of the people, the popularity of Government, of its officers, and such like matters, should be studied and given effect to by *temporary and revocable orders* emanating from the Forest Department. I object utterly to the present custom of the grant of privileges by Government Resolution. In most cases the people have asked for these privileges from revenue officials of all grades, who have expressed their sympathy. When the resolution comes out, we are made to appear as dire oppressors, only kept in order by the vigilance of a beneficent Revenue Department. When any privileges are granted by Government, it should be done by orders through the Conservator to the District Officer, who would publish and give effect to them. Petitioners to Government should merely be informed that the Conservator had orders to grant feasible requests, and would no doubt do his best for them. Any claims to *rights* would of course be shortly referred to the Settlement Resolution.

With regard to the pretty fiction of the Forest officer being an "Assistant to the Collector for forest affairs," I look upon it as a farce; which must be abolished, and the sooner the better. I cannot produce the evidence, but have a strong impression that the plan was invented by Dr. Brandis confessedly as the only means of preserving the infant Department from being incontinently butchered by its jealous uncle. There is no imaginable necessity for such connexion, and the practical inconveniences are grave. Delay of business, waste of paper, stamps, time and pay of Karkuns, the friction due to many wheels, the incompetence and vanity of a few, a very few, Collectors, though they would not admit it, &c., &c., last, but not least, the ignorance in forest matters of the junior Under Secretary. Of course the Collector could claim assistance in the management of any forests that might not be in charge of the department. Personally, I do not approve of the existence of "unreserved forests," whatever the term may mean in different places, and look upon it as a mere salve to conscience I would have all forests reserved, State, if possible, otherwise village. If they are not forest at all, but grazing grounds, they should not concern us, but the Revenue officers.

With regard to pay, the Inspector General should be a Secretary to the Government of India, paid as such, and Conservators should be paid at the same rate as Collectors.

Notwithstanding the depressing fact that a certain Great One, whose departure was a greater success than his administration, did not see fit to belaud our Department, I will venture the suggestion that, now all Departments are in imminent danger of being swamped, it is time the dazzling title of C.S. was either abolished or enlarged to comprise all *specially trained European* officers of all services.

'JOB."

A HIGH FOREST OF *QUERCUS DILATATA.*

THE following rough experiments and notes were made in an oak forest near Murree, and may be of interest in view of the fact that the forest closely resembles similar growths in Europe, and that such are believed to be—in the Punjab Himalaya at least—few and far between.

The area forms a compact piece of forest in one of the tracts recently reserved under the Rawalpindi Forest Settlement, and is traversed by the Kashmir road five miles beyond Murree. The forest consists of a regular high growth of oak (*Q. dilatata*), the trees being of an average height of 100 feet with a girth of 6 feet.* An undergrowth of suppressed oak poles and seedlings, with yew and broad-leaved trees, among which the bird-cherry, maple and horse-chestnut predominate, covers the soil, which is also plentifully carpeted with maiden-hair and other ferns. The underwood is entirely dominated by the large oaks which form the upper canopy, with their rather ill-grown crowns touching one another almost uninterruptedly. The girth of the oaks ranges up to 12 feet at breast-height, and the stems as a rule, are tall, straight and clean, with the lowest branches at from 60 to 80 feet from the soil.

The result of a rough valuation survey gave on an area of 56·5 acres, the following stock of oak, young trees less than 3 inches in diameter, and individuals of other species being neglected.

Diameter between :—

3″—6″	6″—12″	12″—18″	18″—24″	24″
263	421	462	519	892

This gives a total of 2,557 trees, or about 45 per acre. Of those above 2 feet in diameter, a considerable percentage was of very large dimensions, and this would probably account for the average girth of the whole, taken with the automatic tree-measurer being found equal to 6 feet 6 inches.

Time did not admit of systematic experiments and observations being made, but in order to arrive at some idea regarding the annual production in cubic feet, a tree of this girth, 102 feet total height, and growing in average conditions, was felled, and carefully measured up in imaginary billets. The age, from the rings, was taken at 125 years, and the real volumes of the bole and crown, proved to be respectively 105·6 and 7·8 cubic feet. The bole was taken at 66 feet in length, the first branch occurring at this height. As showing the small tendency of these stems to taper in, it may be mentioned that from this and

* Considering the large demand for staves for casks for the Hill Breweries, it would be well if experiments were made to decide on the suitability of *Quercus dilatata* for the purpose. Such experiments are already in progress in Jaunsár.—[ED.]

other specimens, it appeared that the girth decreased by only 0·5 inch for every running foot in length up to 50 feet.

Assuming that the average oak in the forest cubed 100 feet, with a corresponding age of 125 years (and this latter figure is fairly justified, the fertility of the soil which is of great depth and richness being considered), the following figures are obtained :—

		Cubic feet.
Total standing stock (oak),	...	2,55.700
„ average annual yield,	...	2045·6
Average annual yield per acre,	...	36·2

The latter figure should evidently be increased by the average yearly increment of the young oak and the inferior dominated species, although this quantity would probably be represented by a small figure only. Again, the area has never been worked and is practically a virgin forest, so that the opportunities which thinnings would have afforded to the oak to develop laterally, and to otherwise increase the mean annual production, have been entirely wanting.

In view of these considerations, and also because the quantity 36·2 cubic feet is believed to equal if not exceed the average annual production in high forests of similar species in Europe, and in which improvement fellings have not been carried out, this figure might well be called in question. It is however, believed to be within the mark; and the writer has certainly never hitherto, seen an oak forest of similar age in which the growing stock as regards number approached that in question, and especially in which the trees were of such uniformly active growth and good condition.

It would be interesting to ascertain the origin and history of this uninjured piece of forest, surrounded as it is by younger growth and different species, and by villagers moreover, who appear almost to take a wanton pleasure in hacking, lopping or otherwise damaging any tree-growth in their path. The inhabitants are Muhammadans, who relate merely that they were forbidden in the Sikh times and previously to injure the forest; but it appears probable that, at some earlier period, the area was preserved and used, as is so often the case in the hills, as a sacred grove.

VAGRANT.

MISUSE OF A STANDARD BOOK.

IN the "Indian Engineer" of 8th January last, there is reprinted from the "Revue Coloniale Internationale" an "Extract from Report of Commander V. Lovett Cameron, R.N., C.B., on the Colonial and Indian Exhibition, South Kensington." The reprint is headed "Note on the Timbers of India," and appearing as it does in a professional periodical, one might ex-

pect it to be of some use to an Engineer. But as a glance showed it to be full of mistakes, whether of the "Reporter" or the printer, I have taken the trouble to go through it and note them, for the amusement of your readers.

First of all, however, I would inquire how came the sailor and distinguished traveller whose report is made use of to report on the "Colinderies"? He is surely not an authority on things in general, and he is certainly not an authority on Indian timbers, for, with the exception of a statement that piles of anjan (*Hardwickia binata*) that have been standing twenty years in water show no signs of deterioration, the only information he gives about any of the timbers mentioned in his "report" is simply cribbed in an abbreviated form from Gamble's Manual, or perhaps copied from the labels on the specimens exhibited. Probably, therefore, the "report" is merely that of the gallant officer in the capacity of a special correspondent of the "Revue Coloniale Internationale," a print that I have not come across, and the importance of which therefore I cannot estimate.

Taking the mistakes and misprints in the order in which they occur, I find, first, "siss" mentioned as one of the woods of which the ornamental archway at the entrance to the Economic Court is composed.

An attempt is made to give the botanical names of the trees which yield the timbers, but the author's name is never given, and in every case the specific name is printed with a capital initial, though only 8, I think, of the 31 in the list should be so printed.

The weight of *Acacia arabica*, Willd., is given as only 45 lbs. per cubic foot, whereas the average weight should be 54 lbs.

Alstonia scholaris, R. Br., is printed "Alstonia Scholari."

Anthocephalus Cadamba, Bth. and Hk. f., is printed "Antho cephalous cadaruba."

"The wood of the Jack fruit tree is said to be exported to Europe for brush "tacks," instead of "backs."

The vernacular name for *Bassia latifolia*, Willd., is printed *Makua*.

The *toon* tree is said to grow to a height of 60 feet in Burma and Assam. Gamble says 80 to 100 is common. Capt. Cameron correctly quotes Gamble as saying that this timber resists the attacks of white ants; but I doubt if this is strictly true, for while I was serving at Akyab, the whole of the seat frames in the Church there had to be renewed, and my recollection is that they were of toon wood, and that they were so eaten up by white ants that I could push my fingers through them.

Chloroxylon Swietenia, D.C., is printed "Chloroxylon Swietana."

Hardwickia binata, Roxb., is printed "H. Benata."

Heritiera littoralis, Dryand, is printed "H. Litoralis," and it is said to grow quickly on "ided" lands, instead of "tidal."

Juglans regia, Linn., is printed "Junghans Regia."
Lagerstrœmia Flos-Reginæ, Retz., is printed "L. Flos-Regina."
Machilus odoratissima, Nees., is printed "M. Oderatissima."
Melanorrhœa usitata, Wall., is printed "Melanorrhia Usitana.
Ougeinia dalbergioides, Benth., is printed "Ongenia, Dabelgioides."

A table exhibited is said to be made out of a "crop" section of *padouk*, instead of out of a "cross" section.

Sál is said to be a large "jugarious" tree instead of a "gregarious" tree, and the weight of the timber is given as 53 to 70 lbs. instead of 54-55 lbs. per foot.

The weight of *Terminalia tomentosa*, W. and A., is given as 71 lbs. per cubic foot, whereas 59 lbs. is the average weight of 13 specimens, including only one so heavy as 71 lbs.

Xylia dolabriformis, Benth., is said to be found in South India and Burma, and the important forests of that tree in the Central Provinces are not mentioned.

On the whole, while there seems no reason why this "Note on the Timbers of India," which is merely a meagre compilation from Mr. Gamble's book, should be paraded in the "Indian Engineer" because it has so distinguished a name at the head of it, I think that the printer and editor are to blame for most of the ridiculous blunders it contains.

C. W. Hope.

FIRES IN FORESTS.

With reference to "Q's" note, on page 28 of the "Indian Forester" for January 1887, it seems to me a little difficult to compare the effects of an occasional fire in a forest successfully protected for some years with the effects of annual fires. In the case of annual fires, all that there is to burn is the year's growth of grass with the leaves and branches that may have fallen during the year, and a few fallen trees. The soil, owing to its being charred regularly and to no humus forming, is always poor and deteriorates slowly but surely. But a fire sweeping through such forests is, as a rule, of short duration, though fierce, and does not, I think, cause so much damage to standing trees that have risen above the grass as it would where there is an accumulation of decaying wood and much undergrowth which yield to the action of fire and carry it up to a greater height with longer continued influence. In such places, too, fires smoulder for a long time at the roots of large trees and work greater harm. I am told, on good authority, that some years ago a fire broke out at Kegda, in the Beiraghar Reserve, and burnt over 75 acres that had been successfully protected for about seven years. The evil effects on young poles and on older trees was very great, and remained evident for years afterwards.

The only way in which one might understand the Inspector General's remark is by saying that in a forest which has been successfully protected for years the grass will in parts have been entirely killed off, and the undergrowth may be so fresh and green and vigorous that fire, on reaching such places, will die out. But other portions will have been burnt, the slowly formed and valuable humus will have been destroyed, unburnt parts will have lost the shelter they had hitherto enjoyed, the labour, time, and growth of years will have disappeared, and the officers in charge are disheartened. Inasmuch as what has been destroyed was so much more valuable than the property on land annually burnt over, I cannot but disagree with the Inspector General, and hold that the effects of fire in a protected forest are intrinsically more disastrous than in an unprotected forest. *A fire in a forest is a public enemy.* It is infinitely worse than even *over-grazing.* Nature, with a kindly hand, may do her best to cover over the wound, but the evil has been done, the constitution of young trees has been rudely shaken, the soil robbed of its nourishing properties for years, affords but little food for either old or young trees; and to say or do anything which would lead subordinates or others to think that an occasional fire is a thing which, after all, may be, possibly, not so *very* harmful is much to be regretted.

G. J. v S.

January 1887.

NOTE.—The point our correspondent "Q" wished to press was, whether the protection of a forest from fire is worth undertaking, if there is much danger of an occasional fire, and whether the harmful effects of such fires counterbalance the good results of several years of successful protection. Our experience in sal forests leads to the view that the strength acquired in the roots of saplings during several years of protection, enables them to produce very strong stool shoots even when killed to the ground by a bad fire. These would never spring up in an annually burned forest. This restorative effort of nature is much enhanced, if stems injured by fires are cut back to the ground. Other larger trees also get their crowns beyond the reach of fire, or become protected by the thick bark, and thus, for both these reasons, the damage done by an occasional fire is diminished. In the case of chir, which can hardly be said to coppice, though something very like it occurs in burned saplings, the taller plants gradually get beyond the reach of a fire, the bark of saplings being very thick and corky, and every year during which the forest escapes, is a distinct gain.—[ED.]

SHIKAR.

THE following account of a man-eating tiger may be of interest, and may give some information. This tiger was an old male, and worked his wicked will on the human beings frequenting a certain ghat forest within a radius of some 10 miles, and had his own way of it more or less for a period of about three years. The District authorities took every means to circumvent him; large rewards were offered; the best local shikarries were enlisted and employed for months, and to encourage and give

them some status, a few picked Police Constables accompanied them, but they failed to bring stripes to book. On one occasion this band of braves came on the tiger having his noon-day siesta—they all went forward in a body and fired a volley, but the only effect it had was to make him run away. I do not know how many human lives this tiger had accounted for, but one village elder told me he had sat over 22 human "garas" without getting an opportunity of firing off his gun, and others tell the story of their fighting him with their axes and having hair breadth escapes. Two horses belonging to an officer who was marching through these parts were let go during a scare; with difficulty and by offering a good reward he got a dozen men to go in search of them; they returned without the steeds, but minus one of their number, whom the tiger had seized. This same officer then hit upon the novel idea of having a large bamboo cage built on a cart, sufficient to hold himself and two others, and on a smaller cart he had a 'mummy' erected. He then with the others in the cage, and having the mummy cart attached close behind, drove through this forest, and *shouted* for the tiger as they went along; the bait took, for presently stripes was to be seen only five paces distant worrying away at the mummy, and evidently thinking there was something inside beneath the clothes; however, what with the jumping of the bullocks, &c., the bullet missed its mark. After this several local shikarries tried their luck, and fixed their guns on to a human gara—this nearly succeeded, and the tiger went off with a broken leg, they followed him, but this only resulted in one of their number being killed. At last our sporting Chaplain tried his luck, and had a buffalo "gara" tied, this was killed, and he sat over it. Most men, even natives, would have succumbed to sleep by mid-night or sooner, but this veteran believed in his luck, and kept patiently on the alert, and towards the small hours of the morning the two hyenas which were having a repast rushed from off the gara, and then stripes glided into view quietly and stealthily—the murderer that he was—and got his quietus; he was covered with scars and wounds received from many an axe fight with the Gonds.

February 1887. C. P.

SNEEZEWOOD.

Mr. Hutchins writes from King Williamstown, Cape Colony, as follows:—This is a bad year for sneezewood seed, but I send you a little of what I have, being anxious to hear of sneezewood growing in India.* As far as I can remember,

* The sneezewood seed has been sent to Ranikhet, Chakrâta and to the Punjab, and some boxwood seed will be sent from Jaunsár to Mr. Hutchins.—[Ed.]

you have no thoroughly durable wood in India, wood that you can put into the ground like a stone, and take up after 30 years with no signs of decay. Of course, in the ground, teak cannot hold a candle to jarrah and sneezewood. And since sneezewood grows on the mountains of Eastern Africa, a long way up into the tropics, where there are regular summer rains as in India, I do not see what is to prevent the acclimatization of sneezewood on the other side of the Indian Ocean. We are planting a good deal of jarrah in our plantations. The seed is more easily procured, though we have to send to Australia for it, and jarrah grows quicker than sneezewood. But in India, where you cannot grow jarrah, you might as well try sneezewood.

Forest work in this part of the Colony has taken a new start, with the employment of convict labour in tree-planting. Free labour is at exorbitant prices, 1*s.* 6*d.* a day for coloured men, and 3*s.* for unskilled white men. But sheep stealing is such a common crime that the prisons are always populous centres, and now the sheep stealers are planting trees! I expect that we shall soon have 200 convicts at work planting the upper slopes of the Amatola mountains. The indigenous forest is like the Shola forest of the Nilgiris on a large scale; and exotics thrive on the grassy slopes above and around the indigenous forest, as the Australian trees thrive on the Nilgiris.

I should be grateful if you could procure me a little good boxwood seed from the Himalayas.

D. E. HUTCHINS.

II. REVIEW.

REPORT ON THE FOREST ADMINISTRATION OF LOWER BURMA FOR 1885-86.

TAKING into account the disturbed state of the country in Burma during the year, forest conservancy may still be considered to have made satisfactory progress. The Tenasserim Circle remained under Colonel Seaton's charge, whilst Mr. Popert held Pegu. The latter officer, with the commendable object of making the Forest Act and Rules intelligible to the people, prepared an explanatory note, copies of which both in English and Burmese were widely distributed throughout the province.

The area of reserved forests was increased by 530 square miles, the total area of the two Circles being now nearly 4,500 square miles, which, however, includes 423 square miles set aside for the Karens, and in which 'toungya' cultivation is permitted. Sixteen square miles of the Thayetmyo East Yoma reserve bordering on the old frontier line were thrown open in order to encourage settlers from Upper Burma.

The working plans of the Kôn Bilin, Kadin Bilin and Môkka Bilin reserves, which were completed during the year, are awaiting sanction.

The prevalence of dacoity interfered materially with the working and general administration of the forests, as will be seen by the following extracts from the report:—

"The work of all survey parties under Mr. Hörst was seriously interrupted upon several occasions by bands of dacoits, and eventually, on the 17th of April, field operations had to be entirely suspended. An interpreter and three khalasis met with a brutal death at the hands of the dacoits, and Mr. Gibson narrowly escaped. By this untimely closing, about six weeks of the working season were lost. The area actually surveyed was 131 square miles on the 2-inch scale, and 199 square miles on the 4-inch scale, the cost being estimated at Rs. 347-8 a mile, or Rs. 49-8 more than in 1884-85."

This appears very high to those acquainted with the cheap yet excellent maps turned out by the Imperial Forest Survey in India, but in any comparison between the two surveys the dearness of labor, and the disturbed state of the country in Burma are both important factors which cannot be neglected.

"The state of the country precluded an examination of the boundaries of the more northern reserves in the West Salween Division.

"About 1,500 logs and pieces from the Upper Salween forests failed to arrive during the year, owing to the disturbed state of the country near Papun.

"Boards round the Karen areas in the Kabound reserve have still to be put up, the work having been stopped by dacoits.

"In those Divisions of this Circle (Pegu) which have been overrun with rebels, as might be expected, fire-protective measures have failed. Unfortunately the Tharawaddy and Prome Divisions were among these, and reserves which have been protected since 1873 and 1876, as well as plantations protected since their formations, have been wilfully fired, and but a small percentage has escaped. The damage sustained can only be ascertained later on, as up to date the Divisions were not sufficiently quiet to allow of an officer's travelling in the forests unattended by a large guard.

"The bungalow at Myetkyo has been completely destroyed by dacoits; nearly all the rest-houses in the Tharawaddy Division have shared the same fate."

The offences against forest rules were more numerous than in the preceding year. In the Tenasserim Circle two individuals, named Tun Lagyi and Nga Kyi, were convicted of personating Forest officers, an offence now and again cropping up in the province.

Out of 111,929 acres the protection of which against fire was attempted, only 77,414 acres were saved from causes mentioned above. The Karens in Tharawaddy and the Shan villagers at Magayi rendered valuable assistance in putting out fires, and their services will probably be specially recognised by the Chief Commissioner.

There are now 3,746 acres of regular plantations, the Magayi and Kyetpyugan teak plantations having been increased by 53 acres during the year. 1,909 acres of toungya grounds were planted up with teak alone, and 260 with teak and cutch mixed. These plantations were made in lines 9 feet by 4 feet, and are on the whole a success, especially in the Pegu Circle, where the average number of plants per acre is 1,013. The total toungya area now planted up is over 10,000 acres. Some of the old ones were weeded as follows:—

	Acres.	Cost per acre.		
		Rs.	As.	P.
Tenasserim, ...	738	1	13	3
Pegu, ...	2,441	2	2	4

The cultivation of exotics is being carried on in the usual fitful way. The Ceara rubber is flourishing both at Tharawaddy and at Magayi; at the latter place two of the trees have seeded, and the seeds were to be put out in the rains.

It has been decided not to make Thandaung a sanitarium for troops, and it is proposed to abandon the cinchona plantation there.

The Tenasserim reserves enjoy an absolute immunity from grazing rights, and in only one case has the temporary privilege, of grazing a certain number of elephants in the Mekkane reserve, been granted to some of the adjacent villages. A similar satisfactory state of affairs is also to be found on the Pegu side, where fees were received on 372 head of cattle only.

At Moulmein the crane platform with jetty, erected at a considerable cost at the Battery Point depôt, and intended for use in shipping padauk timber, cannot be used at present, as the crane gave way owing to a flaw in the metal.

Minor obstructions in several streams, used for floating purposes in the Tharawaddy and Toungoo Divisions, were removed at a cost of a little over Rs. 1,100.

The steam-launch *Attaran* travelled 5,827 miles during the year, whilst the *Forester* was employed by the Military authorities until the end of June, when she was sent to Upper Burma.

From the review by the Chief Commissioner, we observe that the quantities of timber removed from the forests were :—

	Teak.	Other kinds.	Total.
	Cubic feet.	Cubic feet.	Cubic feet.
By Government agency, ...	1,603,650	217,050	1,820,700
„ purchasers, ...	16,550	2,079,200	2,095,750
„ free permits, ...	21,850	43,300	65,150
„ lessees of forests, ...	130,100	19,050	149,150
Total, ...	1,772,150	2,358,600	4,130,750
Outturn of previous year, ...	2,400,400	4,239,100	6,639,500
Decrease, ...	628,250	1,880,500	2,508,750

The decrease in teak is explained by the disturbed state of the country near Papun, and by the heaping of several thousand logs on the Pegu side. The decrease in the export of timber of other kinds was probably in a great measure due to the cheapness of second class teak of inferior quality during the year. Of such timber pyingado *(Xylia dolabriformis)* was the principal one removed by Government agency, 81,569 sleepers having been prepared, about two-thirds from the Rangoon Division and the remainder from Tenasserim. 75,000 of these sleepers were sent to Madras, and the remainder to Calcutta for the Northern Bengal State Railway. We presume that all these sleepers were metre gauge ones, but this is not clear from the report. The profit on these sleeper works in the Pegu Circle amounted to 36 per cent. In addition to the pyingado exported, 18,600 cubic feet of padauk were sent to Bombay and Madras, and small quantities of ingyin

(Shorea siamensis), pyinma *(Lagerstrœmia Flos-Reginæ)*, kanyin *(Dipterocarpus lævis)*, thitto *(Sandoricum indicum)*, thitka *(Pentace burmánica)*, were also worked out and sold locally. Some large and very select shipments of thitka were shipped to the home market in the expectation of competing with mahogany, the importation of which of late years into London has consisted to a large extent of small-sized timber of indifferent quality.

Of the timber removed by purchasers, 2,329 cutch trees were sold from reserves in the Prome and Tharawaddy Divisions, and 3,000 pyingado trees from the fuel reserves of the Rangoon Division, but why the latter are not shown in Form 54 is not known.

Free grants are made of the reserved trees from unreserved forests both by the Commissioners of Divisions and Conservators of Forests. The leased forests are chiefly in the Attaran and Salween Divisions of the Tenasserim Circle.

The yield from the unreserved forests was more than four times as much as from the reserved, and in the case of teak about twice as much, but the ratio is likely to decrease year by year as more reserves are formed and as the unreserved forests get worked out, whilst the reserves are brought into regular working by means of working plans.

In the Tenasserim Circle 1,930 teak trees inside, and 368 trees outside, reserves were girdled, besides 250 padauk. In Pegu 15,576 teak were girdled, 13,870 inside and 1,706 outside the reserves, besides 300 pyinma trees. The girdling operations in Tenasserim were carried out in accordance with the rough working plan for the East and West Salween Divisions, and it is with reference to some of these tracts that the Conservator remarks that—"too small a percentage of the first class trees have been left to shed seed, as although those of the second class were fairly abundant, yet their presence could not be depended upon in every instance to insure an uniform distribution of the seed."

On the Tenasserim side duty on minor produce is usually levied on the number of individuals collecting such produce, and not on the quantity removed. In the Pegu Circle the principal articles are cutch, bamboos, wood-oil, thitsi, cigar-leaves and straw fibre, the revenue amounting to Rs. 73,295, of which over three-fourths were derived from the unreserved forests. Cutch is by far the most important item amongst the minor produce, the revenue from it having been Rs. 55,420 in the unreserved, and Rs. 11,360 in the reserved, forests. 1,027 free licenses to boil it were issued by the Deputy Commissioner of Thayetmyo as a means of relief to cultivators whose crops had failed.

Judging from their yield in timber and other produce, the unreserved forests must be still very extensive and valuable, and we should think that large areas yet remain to be formed into reserves in Lower Burma, and thus saved from future destruction.

During the year, 26,629 drift logs and pieces were collected, a number greatly in excess of previous years, which was owing to the very high floods.

The statement of the outturn of foreign timber in Appendix E, appears to be only for timber imported into Moulmein, and not to include that which reaches Rangoon. On the Moulmein side the imports show a decrease of 35 per cent., due in a certain degree to less undersized timber having been brought down. The imports by the Irrawaddy decreased owing to the Expedition which took place during the floating season. The two forests yielding the largest quantities of timber were Karenni, with 69,413 full-sized logs, and Ningyan with 61,265, the latter, which comes down the Sittang, being the greatest quantity ever extracted from the forest in one season.

The quantity of teak exported was about 20,000 tons in excess of the exports of the previous year, 105,240 from Moulmein, one-fifth going to England and her Colonies, and the rest to India, and 63,368 tons from Rangoon, of which two-thirds were shipped to India.

Colonel Seaton says that the export trade during the year has been the most unfavorable on record. The stocks on hand in the home market at the close of the year were not far short of 30,000 tons, owing to nearly all the later arrivals being stored on importers' or shippers' account, as the result of the ship-building trade having come to a stand-still. The Clyde market was also greatly depressed by false reports of a large increase in shipments of teak from Rangoon as the outcome of the annexation of Upper Burma. At the close of the year also at Moulmein all the European owned saw-mills were standing idle.

The exports of cutch and gambier amounted to the large sum of 26 lakhs of rupees, or about half the value of the exported teak.

The net revenue was Rs. 8,22,906 as compared with the abnormally low surplus of Rs. 4,58,748 in the preceding year. The Chief Commissioner considers the result to be satisfactory in view of the many adverse influences at work throughout the year.

THE TIMBER MARKET.

CHURCHILL AND SIM'S WOOD CIRCULAR.

London, January 1st, 1887.

THE accounts of the import trade compiled at the Custom House furnish the following statistics :—

Wood imported into the United Kingdom in the following years :—

Years.	Colonial Sawn Wood (Deals, Battens, &c)	Colonial Hewn Wood (Timber and Hardwoods).	Foreign Sawn Wood, (Deals, Battens, Boards, &c).	Foreign Hewn Wood (Timber and Hardwoods).	Colonial and Foreign Staves.	Total.
	Loads.	Loads.	Loads.	Loads.	Loads.	Loads.
1881, ..	994,149	298,514	2,674,698	1,567,785	118,664	5,653,810
1882, ..	1,010,413	277,745	3,166,347	1,740,662	125,696	6,320,863
1883, ..	1,181,606	336,184	3,132,027	960,999	141,189	5,752,005
1884, ..	976,148	230,759	3,069,118	1,721,250	135,650	6,132,925
1885, ..	995,374	255,264	3,234,944	1,679,397	124,374	6,289,353
1886, ..	948,349	159,014	2,834,851	1,418,978	130,708	5,491,900

Value in 1885, £14,758,747 ; in 1886, £12,135,264.

For the last five years we have had to report the wood trade of London as being in a very depressed condition, but of none of those years was it necessary to give such gloomy accounts as of 1886. Prices, which in January were believed to have touched the lowest possible point, continued to recede until the end of the year ; and consumption, which, in spite of an abnormal cheapness of supply, had been failing for some years, and which was also thought to have reached its lowest in 1885, has again experienced a further serious decrease. An idea of what this shrinkage in the demand has been will be quickly gathered from the following figures :—In 1881, the consumption of deals, battens and boards was 29,650,000 pieces ; from which total it has declined to 26,860,000 pieces in 1886. These quantities represent the delivery of deals, battens and boards of the Port of London both from the ships' sides and from the docks, but they do not alone show the extent of the loss of consumption, for each year the average size of these goods grows less, and the falling off in actual quantity is consequently greater. It being impossible to arrive at any reliable estimate of the cubical measure of overside deliveries, we give the statistics published by the Dock Companies of their deliveries, which show an actual quantity of 250,000 Petersburg Standard Hun-

dreds drawn from their yards in 1881, against 188,000 in 1886—each intervening year the quantities growing smaller.

In the five years of which we have spoken the trade has undergone a complete revolution; the old class of merchant dealing in wood as one of many branches to his business has almost disappeared, and is superseded by the shipper himself, or by his specially appointed agent; among the dealers also many of the large wealthy firms have ceased to exist, either by voluntary abandonment of the business, or from inability to cope with the altered state of things. The consequence is that the trade is carried on by a more numerous, but less powerful, class of buyers, whose dealings partake more and more of a retail character, and who are less able to bear the frequent falls in price and the continuous bad debts which have been the bane of their trade. Competition has necessarily become greater, until the dealer's business, which used to be one of the most prosperous in the country, has become precarious and unprofitable.

Much of this can be traced to the introduction of steamships into the trade. It naturally follows that with supplies within two or three weeks' call from the shipping ports (instead of as many months in the days of sailing vessels) it becomes very difficult for holders here to obtain an advance on shippers' prices. The current demand therefore gets to be fed in increasing proportions direct from those ports, and as steamers can so time their movements as to load from the first days of spring till the last days of autumn, there is practically no cessation to the arrivals, and no longer either place, or necessity for large holdings of stock.

Many of these circumstances, while no doubt injurious to individuals, do not of themselves prove any decline in the trade generally, the feeble state of the consumption, which no cheapening of price now seems to stimulate, is of fuller significance. The great demand comes from the building trade, but with empty houses abounding, and as a consequence rents rapidly falling, there has been little to encourage the erection of new dwellings, and from such agricultural districts as London still supplies the demand has fallen away comparatively to nothing. As the wood trade has always been the last to participate in any improvement in the general trade of the country, there is but too little reason to expect any immediate, substantial change for the better.

East India Teak.—The importation of logs and planks has been:—

1884–16,000 Loads. 1885–11,558 Loads. 1886–18,000 Loads.

It will be observed that there is a large increase in the stock, the reason being that absence of demand from the shipbuilding rivers has compelled shippers, in spite of tempting and wholesale reductions in price, to land an unusual proportion of the supply

here. Since the beginning of the year quotations have fallen some 25 per cent. The most satisfactory feature in the position is that this cheapening has led to teak being much more freely used for general purposes than formerly, so that the loss of consumption in shipbuilding has been made up in other trades. Very circumstantial reports come forward of a great reduction in the supply, to which buyers will pay little attention until it becomes an accomplished fact, but it is reasonable to suppose that the present abnormally low prices will check production and increase demand, and it is certain that even a slight movement in that direction will have a very considerable effect upon the market. Teak has never before long remained at its present low value.

The total consumption has been 11,114 loads against 10,899 loads in 1885.

THE TEAK MARKET.—Messrs. Denny, Mott, and Dickson's wood market report of December 15th states that "Deliveries last month from the docks in London show a marked improvement, having amounted to 1,168 loads as against 470 loads in the corresponding month of the previous year. Purchases for consumption on the Clyde approximated to 2,500 loads for the month, and an important quantity has also gone into consumption on the Tyne and neighbouring ports. Many competent judges deem this increased shipbuilding demand to be the commencement of a permanent improvement in this industry, and there is a growing disposition on the part of builders to utilise the keen competition between sellers in order to elicit low offers, with the object of augmenting their stocks, and providing against the scarcity of teak, which, it is now admitted on all hands, must arise, should the improved demand continue, even on the present moderate scale. The present year's imports of teak to Europe are now estimated to be about 27,000 loads less than those of last year. The unprecedentedly low stocks at the Burmese ports, which cannot be augmented before the latter part of next year, are further reduced, so far as the home market is concerned, by the large proportion they comprise of timber unfit for shipment to Europe, and which can only be disposed of in the Indian market; the proportion of such timber in Moulmein being about 75 per cent. of the whole visible stocks; and it is still very doubtful whether any supplies at all can be got down from the Rangoon forests, even next autumn. There are not wanting signs that operators in Burma are contemplating the facts of the situation with a view to securing all available stocks, and such a policy, if carried into effect, would force merchants, as well as consumers, on this side to submit to a very heavy advance in price when the (as yet sufficient) stocks in the United Kingdom should have become a little more reduced."—*Timber Trades Journal.*

IV. Notes, Queries and Extracts.

Rab.—The Government of Bombay has published a most interesting report by the Director of Agriculture on experiments with *rab*, which is, both literally and metaphorically, the burning question of the day in the agricultural districts on and near the Ghats. *Rab*, as all the world now knows, is a term applied to the several systems in vogue in this presidency for preparing, and usually also burning, manure. It is a term also applied to the finished product. Mr. Ozanne distinguishes three kinds, namely, (1) cowdung, (2) *ain*, and (3) *fangal*. The first consists of layers of cowdung, straw, grass, earth and pit manure; the second of freshly-cut *ain*-loppings, coarse grass, straw, earth and pit manure (*ain* being the vernacular name of a common jungle-tree—*Terminalia tomentosa*): *fangal* is a shrub (*Pogostemum purpuricaulis*); and the third kind of *rab* consists of layers of freshly-cut *fangal*, grass, straw, earth and pit-manure; this last ingredient consisting of the contents of the dust-bin with some cowdung added. Small plots of land were manured with these three kinds of *rab* at Lanauli, Khadkala, Igatpuri, Karjat and Alibag. At each of these places the results were largely in favour of cowdung-*rab* as regards the yield of cereals; then came *ain*; and last of all *fangal*.

Mr. Ozanne is inclined to value *rab* more for its efficiency in killing weeds and noxious insects than for its manurial properties, but, in our opinion, his experiments tend if anything to show that the mineral constituents of the loppings are the most potent factors in the success of the crop; only in this manner can we explain the superiority of freshly-cut to dry jungle-*rab*, which is apparently due to the fact that, as soon as the green parts of a tree begin to fade, the most important mineral constituents, with which the leaves are, so to speak, saturated during the period of vegetative activity, flow back in large quantities to the stem, there to remain stored up until the next season. It is, however, very difficult to make comparisons or draw safe conclusions, from these experiments, as they vary greatly in regard to the quantities and kinds of material used, as well as the conditions under which they were made; besides this, it is not always quite clear what description of material was used, and the areas experimented on were too small to admit of reliable inferences. Nobody is more alive to the deficiencies of these first trials than Mr. Ozanne himself, who warns his readers repeat-

edly that it is impossible to draw any final conclusions from them ; but, subject to this proviso, he considers that, until the contrary is proved, we may conclude that :—

"(1). The manner in which the ryot utilizes the materials at his disposal is the most economical and the most remunerative. Hence, all attempts to teach him to use manure, or leaves and grass, or the like, in a way different to that in which he uses them, are extremely hazardous and require the utmost caution.

"(2). Rice can be grown without *rab*. The ingenuity of the ryot has discovered substitutes. But I think it is proved that all substitutes are either more costly or more risky than the approved methods.

"(3). Though rice can be grown without *rab*, yet *rab* greatly increases the yield, and, therefore, the food supply of the country. The yield now suffices to support a largely increased population with, I believe, a considerable margin for export. If, however, diminished by prohibitions against, or scarcity of, *rab*, it is a question whether this margin would not more than disappear.

"(4). If the full value of the materials used for *rab* is charged in the cost of cultivation, rice cannot be grown with profit. Even without this charge the margin of profit in a good year, such as that during which the experiments were carried on, is not large. It has to cover the charges on account of true rent, from which must come the assessment both on rice-land and whatever area is appended to rice-land for the growth of *rab* material."

These generalizations, as already observed, are admitted to be hastily arrived at, and should be accepted with caution. There can be no doubt that the first conclusion is wrong ; it is going too far to assert that the ryot's disposal of the materials at his command is the most economical, when, as a matter of fact, it is well known to be the most wasteful, as we shall be able to prove further on. Again, we can find nothing in the report which proves that *all* substitutes for wood-*rab* are either more costly or more risky than the approved methods.

To show how far from closed Mr. Ozanne himself considers his *rab*-question ; how anxious he is not to mislead ; and with what serious misgiving he regards the future of the ryot dependent on *rab*, it will suffice to quote the concluding paragraph of his report :—

"'I trust that these deductions' (those just quoted) 'are sound. They are, at any rate, made from the unbiassed opinion formed after most careful study of the subject. But I am very far from thinking that I have mastered the subject. I have already begun arrangements for continued experiment. My conviction is that the only way to decide how far in the interests of forests, and in those of the people themselves more especially, the drain on the lands which produce the *rab* materials, whether in or out of the forest, can be prevented from causing exhaustion—a point which has been nearly reached in Igatpuri, Khadkala and Lanauli—is to go on with the experiments now begun, to show precisely the position of the ryot and what it is tend-

ing to become, and thus to make it possible for Government to restrain him from improvidence when it is clear such restraint is necessary.' "

As in most other matters concerning forest economy in this country, we may profitably turn to the experience gained in countries more advanced in scientific methods than India, which have gone through, or are still experiencing a phase of agricultural development similar to that which we are now witnessing out here. It does not seem to be generally known, but it is, nevertheless, a fact full of interest to the Indian farmer and his master, that *rab* and *kumri*—the two great evils which threaten to utterly exterminate the hill forests of this presidency—have been extensively practised in Germany, and that *rab* still is rampant in some States, although everywhere steps are being taken to stop it on Government land, because it has been found to be incompatible with the maintenance of the forests. No wonder, then, that, with numerous State-supported laboratories, kept solely for the promotion of forest and agricultural research, German experimental physiologists should have worked out, and be able to explain, scientifically, the effect of *rab* both on the forest, from which it has been taken, and the cereal to which it supplies nutriment.

It is not possible in the short space of an article to go fully into this wide subject, but we may at all events give briefly some important facts which have been established by numerous carefully-conducted experiments.

All trees consist mainly of certain volatile substances—oxygen, hydrogen, nitrogen and carbon—which are called their organic constituents, in contradistinction to the so-called inorganic elements, which are not volatile. It is with the latter that we are chiefly concerned in this enquiry, because, although all trees consist of over nine-tenths of organic elements, they are dissipated in the *rab* process by burning, and it is only the residue, or ash, that is available for direct use as a fertilizing material. Of these constituents about 45 per cent. are carbon, which is assimilated only by the leaves in the form of carbonic acid, which is always contained in small quantities in the atmosphere, and about 48 per cent. consists of oxygen and hydrogen, which are taken up by the roots of plants in the form of water and in other ways. The loss of these three elements in burning *rab* is consequently of minor importance, but nitrogen, which is taken up solely by the roots, is irretrievably lost in the air and more difficult to replace.

The essential inorganic, or mineral, constituents, amounting to about 5 per cent. of the whole tree, consist of potash, soda, lime, magnesia, ferric oxide (iron), manganic peroxide, phosphoric acid, sulphuric acid, silica and chlorine, which are here given in the combinations with organic elements in which they are usually found in the plant. All these substances are taken up exclusively by the roots, and are absolutely necessary for

plant-growth. They are very unevenly distributed in the tree and wander about, according to the season, in the direction in which they are most required by the plant. Consequently, green parts, notably the leaves when green, which alone elaborate the sap that builds up the tissues of plants, contain a large quantity, the bark and young shoots less, and the stem least of all. During the period of active vegetation (in these latitudes, therefore, chiefly during the monsoon) the quantity of organic and inorganic nutriment in the leaves and young shoots reaches its maximum, the former consisting chiefly of starch and sugar, and the latter of phosphoric acid and potash. But when the leaves begin to fade, the quantity of these substances diminishes, and the fallen, or dying, leaf does not contain nearly as much of the most useful nutriment as the healthy green leaf, nor does a dead, or dying, branch contain as much as a healthy one. Schröder found, for example, that the ash of healthy leaves of Scots' pine contained 40 per cent. of potash and 19 per cent. of phosphoric acid; while the ash of dead leaves of the same tree contained 9·5 per cent. of potash and 4 per cent. of phosphoric acid. These two substances are quite the most important mineral constituents necessary for vegetable life, and it is certainly a wonderful provision of nature that they should return to the stem just before the fall of the leaf, there to remain stored up for future use. Viewed by the light of Schröder's experiments, which have been verified by others, it is easy to understand why Rambux insists on cutting his *rab*-fuel when vegetative functions are in full swing. It matters nothing to him that he thereby arrests the growth and threatens the very existence of the goose that lays the golden eggs; he thinks the forest will last his time at all events, and regards the man, who ventures to suggest the propriety of providing for future generations, as hopelessly idiotic

One of the most important questions which the Forest Commission now sitting at Poona will have to decide, in spite of Rambux's supineness, is whether the forests can stand the drain to which they are now subjected or not, and Mr. Ozanne has rightly drawn our attention to this part of the subject which is of such vital importance to the *rab*-cultivator. If, as at present constituted, they cannot stand the drain, and if further provision cannot be made to extend the loppings over a larger area, so as to make the effect less disastrous, the situation will be a very awkward one. In that case, if things are allowed to slide in the present happy-go-lucky manner, the final collapse may be postponed indefinitely, but it must surely come, and the last condition of the farmer will be at least as bad as if steps had been taken to grapple with the evil now. On the other hand, if Government decide that *rab* must be stopped or curtailed in Government land, there will be a general howl of indignation from cultivators—who possibly may, with justice, claim a right to

rab—egged on by a crowd of professional agitators and others not interested in the maintenance of the forests. What hope, then, is there that Government may escape this dilemma? If we turn to the facts elicited by German experimentalists, the prospects of the farmer dependent on *rab* are not encouraging, no matter whether the practice be put an end to by Government interference or not. As everybody knows, the soil of an un-rabed forest is yearly enriched by débris of branches and leaves which, in decaying, supply a quantity of organic and inorganic nutriment to the forest. If this litter be removed from a hectare (2½ acres) fully stocked with beech-trees, the soil loses annually, on an average, according to Ebermayer's experiments, 3,147 kilogrammes of organic and 185 kilos. of inorganic fertilizing matter (a kilogramme being equivalent to 2·2 lbs. Avoirdupois). In forests which are rabed when green, the loss is greater, because green foliage contains more useful mineral nutriment than dead litter; nothing, of course, is done to replace this large quantity of natural manure.

Setting aside deterioration from physical causes, which is very great in forests whose soil is deprived of its natural covering of dead leaves and twigs, we might almost conclude from Ebermayer's experiments that the exhaustion of soils under *rab* could only be a question of time. All farmers know well enough that even the best soils are soon exhausted when they are steadily deprived of large quantities of nutriment, and no manure is substituted to repair the loss; but, if this is the case with agricultural soils, it must, *à fortiori*, be the same with forest soils, which are generally much poorer than cultivated land. Stöckhardt has submitted the matter to a thoroughly practical test by examining two plots of ground, side by side, both stocked with Scot's pine 50 years old, of which one had for some time been deprived periodically of its dead litter, and the other had not been interfered with in any way. The ground was examined to a depth of 20 inches, and the results were as follows:—

The untouched area contained 19,950 kilos. per hectare of mineral nutriment soluble in muriatic acid, and 4,720 kilos. of mineral nutriment soluble in water. The rabed area contained 14,950 kilos. of mineral nutriment soluble in the acid, and 2,865 soluble in water. A very decided deterioration had, therefore, taken place in the supply of mineral nourishment, but the loss of organic nutriment was naturally still more marked. The protected area was found to contain 139,670 kilos. of organic matter to the hectare, and, of this quantity, the nitrogen weighed 8,354 kilos. In the rabed plot, the organic matter amounted to 60,438 kilos. to the hectare, the nitrogen weighing 4,759 kilos. The difference in favour of the un-rabed plot was, therefore, 79,232 kilos. of organic matter. The reader can easily draw his own conclusions from these experiments in regard to the fate

which is in store for rabed forests which are not of vast extent relatively to the area they manure.

Customary usage in Government forests, which in spite of all legal maxims to the contrary, may easily amount to a prescriptive right in the eye of the practical legislator, may necessitate the continuance of abuses, but an abuse which involves the ruin of a valuable State property may perhaps be tolerated, but certainly should not be allowed to spread: the immediate interests of a few must give way to the lasting interests of the many, and, if the evil cannot be eradicated, its growth may at least be arrested. Systematic experiments would in time show whether the area available for *rab* is sufficient to admit of the practice being perpetuated, or if it must sooner or later come to an end: in the meantime, having no actual facts to go upon, excepting those obtained in foreign countries, we have no means of forming a decisive opinion.

Apart from considerations of rights of usage, it appears doubtful if the game is really worth the candle. Even to the farmer, supposing him willing and able to employ his labour in other ways, the advantages are perhaps less than one may easily be led to suppose. Mr. Ozanne, who certainly takes a most unbiassed view of things, but who, as Director of Agriculture, cannot fail to be more interested in the welfare of the ryot than in that of the forests, frankly confesses that, on the evidence collected by himself, *rab* does not pay. It is only by ignoring the wages of the farmer and his family, and the sale value of the *rab*, that a profit is made out. Surely there must be something radically wrong in a system of agriculture, which cannot be made to pay its own way. The amount of labour which the farmer must bring to bear on the *rab* system must be very great in proportion to the effect. Wolff, for instance, calculates that 330 hundred-weight of dry spray and leaves of oak, or beech, would yield one hundred-weight of potash and phosphoric acid, but that the collection and carting to destination of this quantity of *rab* would alone cost more than the value of the same quantity of artificial manure; of course, this statement is probably not applicable to Indian conditions, but it shows that enquiry in this direction would not be without interest.

To show to what extent forest trees are able to supply the mineral nutriment requisite for agricultural plants, we may quote the results of some experiments. The most important mineral compounds of plants are potash, lime, phosphoric acid and silica. According to Ebermayer, a hectare, cropped with the following species, requires these substances in the following average quantities per annum for each species:—

	1. *Potash.*		1. *Potash.*
Potatoes,	... 120 kilos.	Fodder-grass,	... 78 kilos.
Clover,	... 102 „	Peas, ...	... 48 „

1. *Potash.*		Clover, ...	31
Wheat, ...	29 kilos.	Fodder-grass, ...	24
Beech, ...	15 „	Peas, ...	21
Spruce, ...	9 „	Wheat, ...	21
Pine, ...	7 „	Beech, ...	13
2. *Lime.*		Spruce, ...	8
Potatoes, ...	37	Pine, ...	5
Clover, ...	112	4. *Silica.*	
Fodder-grass, ...	49	Potatoes, ...	8
Peas, ...	47	Clover, ...	8
Wheat, ...	9	Fodder-grass, ...	80
Beech, ...	96	Peas, ...	9
Spruce, ...	70	Wheat, ...	27
Pine, ...	29	Beech, ...	63
3. *Phosphoric Acid.*		Spruce, ...	58
Potatoes, ...	36	Pine, ...	7

According to this statement, it would require about three acres of well-stocked beech forest at its best (*i.e.*, before deterioration by *rab* had set in) to provide sufficient mineral nutriment for one acre of wheat; beech, be it noted, being a tree which yields, relatively to most other species, a large quantity of nutriment, and only grows in comparatively good soils.

It would require comparative experiments on Indian forests and cereals, similar to those we have referred to, to enable us to say roughly what quantity of forest of any given description is, on an average, capable of fertilizing an acre of land under given conditions, and to what extent *rab* affects the growth of forests. It is hopeless to expect to arrive at any satisfactory conclusion until these data are worked out, for, although the results obtained in Germany may be considered sufficiently clear and conclusive for that country, it is not likely that people out here will admit that what has been found true for a far off land must necessarily be true for India.

Another matter, to which, no doubt, the Agricultural Department will direct its attention, is a means of more economically exploiting the rabed areas. We have seen what an enormous loss of organic nutriment is occasioned by burning the produce; possibly some method might be devised, by which only a small portion should be burnt and the rest utilized in the natural way.—*Times of India.*

CLIMATE OF MANIPUR.—In connection with Major Macgregor's paper on his journey from Upper Assam to the Irrawadi, read at a recent meeting of the Royal Geographical Society, and printed in the new number of the Proceedings, Dr. G. Watt made some valuable remarks on his own observations in the Manipur district. Manipur is a small valley surrounded by mountain ranges, and in this valley the rainfall was found to be only about 39 inches,

but seventeen miles off in the mountains which formed the north-east ranges, the rainfall was as much as 120 inches, and towards the Naga country to the north it became greater and greater in certain limited tracts. In the Khasia Hills 600 inches might fall in one place, and twenty miles off only 50 inches. Nothing in Manipur struck Dr. Watt so much, as a botanist, as the remarkable transitions of vegetation in that small region. Dr. Watt gathered twelve or more species of oaks, many of which were new to science, and ten or twelve species of rhododendrons, in Manipur alone. The *Rhododendron Falconeri*, found in the Naga Hills by Sir Joseph Hooker, is nowhere met with in the immense tract between the Naga Hills and Sikkim. This and the epiphytic *R. Dalhousiæ*, which grows on a hill thirty miles north of Darjeeling, Dr. Watt found in the Naga Hills at an altitude of 6,000 to 8,000 feet, and these rhododendrons never occur in Sikkim below 10,000 to 13,000 feet. There were many instances of plants falling in their altitude as the traveller passed to the east and south-east from Sikkim, until at Moulmein a rhododendron was found, growing near the sea, a circumstance which was not met with in any other part of Asia. There is something in that region which, apart from pure geography, is of vital interest. Sarameti, which is under 13,000 feet high, the natives said, had snow all the year round, whereas on the Himalayas the lowest point at which snow occurs is 17,000 feet. In Manipur, the whole valley, 3,000 feet high, was covered with hoar-frost in December. Dr. Watt thought this was a point that should be thoroughly investigated: what is the cause of this falling in altitude in the vegetation? General Strachey, who was in the chair, considered that the peculiarities of the vegetation of Manipur compared with Assam were connected with the evident lowering of temperature indicated by the low snow-line. There could be no doubt that the warm currents of air coming up the valleys of the Irrawadi and the Salween and meeting the snowy mountains to the north produced an enormous precipitation of rain, which during winter fell as snow. The consequence seemed to be that there was snow there at a very much lower level than in the mountains further to the north. That an immense quantity of rain fell in the upper portions of the valley of the Irrawadi there could be no question. Such a rainfall seemed in itself quite sufficient to account for the large volume of water that was drained off by the lower portions of the Irrawadi; and anybody who knew what Tibet was, General Strachey stated, must be aware that, even with a course of several hundred miles the river would pick up but a small quantity of water in comparison with the enormous volumes which were collected from the rain which fell in Upper Burma. General Strachey had roughly calculated that a monthly fall of rain of 18 inches over a square degree would mean 65,000 cubic feet per second for the whole month.—*Nature.*

ARBORICULTURE ON THE SULEIMAN RANGE.—The following letter from the Rev. Dr. Jukes, Medical Missionary, Dera Ghazi Khan, will be read with interest:—

"I have just had a conversation with Colonel Thompson about arboriculture, about which I am interested, as I am a yearly visitor at Fort Munro on the Suleiman range, and he advised me to write to you on the subject, and if you can give me any suggestions and help me with seeds or plants to try experimentally, I shall be greatly obliged. The elevation is 6,400 feet, with a rainfall averaging 10 or 12 inches; the soil, when not alluvial in the small valleys, is generally, after removing the surface stones, a stiff clay, and, owing to the dry atmosphere, we have difficulty in finding suitable trees. Plums, apricots and peaches do well, and olives, figs and willows grow in the nallas, but we find it very difficult to grow any forest trees. The cypress does well, but oaks, casuarinas, *Grevillia robusta*, carob, tún, sirissa, holly, have all done badly. Mulberry is the only imported forest tree that has done well, the shisham is indigenous, but stunted, hardly exceeding 20 feet where it grows best. Deodar and allied species have been tried, but in four years have hardly made 6 inches in growth, though in sheltered situations they grow better. Eucalyptus, I do not know the species, grows to 30 feet in sheltered places, but even there suffers from the cold in winter, and on the hill top is cut down almost to the ground.

"Several stunted species of acacia are indigenous, but only attain to the size of bushes. I have been told that trees found on the arid slopes of the Himalayas would probably do well, but I do not know what they are.

"The cold is very intense in winter, and in summer, although the temperature in the shade does not go much above 90° (it varies from 55° to 87° in the verandah), it seems to shrink up the plants from its dryness. If you could help me in the matter, I shall feel greatly obliged. Mr. L. Dames, the Deputy Commissioner, brought some seed of the Mexican forage tree, a species of acacia, one of which I have and that is doing well. He would second all my efforts by raising trees in the gardens about 1,000 feet below Fort Munro. I propose sending a man up in February to plant, and should be thankful for suggestions with or without seeds or plants."

Some *Pinus Sinensis* seed was sent to Dr. Jukes, and *Cryptomeria Japonica* and others will be sent for trial.—*Proceedings, Agri-Horticultural Society of India.*

INDIA-RUBBER.—(From Messrs. Lewis and Peat's Report.)—The total receipts in England of all kinds of rubber in 1886 have been nearly 8 per cent. above those during 1885, but we exported of these a larger proportion than usual to America.

Our own consumption of Para has been very moderate. America continues to largely increase her consumption. Deliveries there (of Para) during 1886 we estimate at 8,000 tons against 7,500 tons in 1885, 5,500 tons in 1884, and 4,900 tons in 1883. The shipments from Para were (shipping weights, and including Peruvian), 13,060 tons in 1886, 12,500 tons in 1885, 11,400 tons in 1884, and 9,800 tons in 1883. The loss in weight in passage this season has increased, and averaged nearly 9 per cent. America received from England nearly 1,000 tons Para last year. Her large purchases here early in the year caused an advance from our opening (January, 1886) quotations of 2*s.* 7*d.* for fine, and 1*s.* 11*d.* for Negro-head. The large shipments to New York in the spring stimulated the market, and we gradually advanced. In July the quotations were 3*s.* 2*d.*, and by September 3*s.* 6*d.* for fine, and 2*s* 8*d.* for Negro-head. This was the highest of the year, and we steadily declined to 2*s.* 11*d.* and 2*s.* 2*d.* in November, but recovered 1*d.* per lb. at the close. Of rubber besides Para our imports are largely increased, and deliveries also, but a great portion for re-exportation; and our own trade has been quiet, though steady. All kinds of good medium rubber have sold very readily at relatively high prices throughout 1886. We received of Assam and East India 301 tons against 270 tons; Borneo, 312 tons against 404 tons; Zanzibar and Mozambique, 1,066 tons (200 tons in transit) against 672 tons; Madagascar, 69 tons against 88 tons; West India and Central America, 111 tons against 181 tons; Africa, 2,318 tons against 1,404 tons; Ceara and Mangabeira 135 tons against 72 tons; sundries, chiefly Peruvian, 193 tons against 220 tons. This year has begun with active demand and few sellers. About 65 tons fine sold from 3*s.* 1*d.* to 3*s.* 2½*d.*; Negro-head, 2*s.* 3½*d.* to 2*s.* 4½*d.*, closing firm.—*Times.*

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THE SYSTEM OF FOREST MANAGEMENT IN SWITZERLAND.

State of the Forests of Switzerland prior to the revision of the Forest Laws.—It is usual to recognise the system of forest management as exercised in Switzerland as the most perfect known in our day. But with this recognition, which is, we grant, perfectly justifiable, must come the consideration that it has been, as we shall presently see, the result of the most pressing necessity. It may, indeed, be bluntly stated as a general axiom, that the last matter which engages the earnest attention of the administration of any country, is the management of its forests. So long as the requirements of the country are satisfied, either by cutting from its own resources, or by importation from without, the healthy state of the forests themselves is not regarded. Or to put it financially; so long as the interest comes in regularly, no one cares to enquire into the security of the capital. The disappearance or precarious state of this comes by way of a startling surprise on the Government of the day, who express, with virtuous indignation, their surprise at the supineness of their predecessors. In no country were the effects of this supineness more clearly shown than in Switzerland. But, fortunately for her, in no country were the powers of conservation and reproduction,—the conservation of what remained, and the reproduction of material to supply the former waste,—more readily at command and more easily brought again under control.

Speaking roughly, 19 per cent. of the total area of Switzerland is under wood; and again speaking roughly, three-fourths of this amount of woodland, belong either directly to the State, or to the Communes who are under State control. With all these resources at command, the regulations formerly in force had so fallen into disuse, that the official reports* of 1858-59 stated that the actual production of the forests was not sufficient for the necessities of the inhabitants, without taking into

* Report of 1858-59-60, by E. Landolt to the Federal Council.

account those of the industries of the country, or of the means of transport. A later report* stated the case with more urgency, if in fewer words, thus—the consumption exceeds the production by 12,089,200 cubic feet, and the importation exceeds the exportation by 14,823,000 cubic feet. The Switzerland of 1863, in short, spent 6 millions more than it obtained for exported wood, on importing wood for its requirements. From the outcome of such continued management, the report proceeded to forecast "certain ruin," and the result was the reorganisation of the Forest Administration as it now exists. While, therefore, it is true to say, as is so often insisted, that forestry has been practised as a science in Switzerland for hundreds of years,—a merit also claimed with more or less reason, by other European countries,—it is equally true to say that the present system of forest management is an infant of only some five and twenty years of age. With these preliminary remarks, we shall proceed to trace the steps by which this infant has attained to a vigorous manhood.

Nature and extent of the Swiss Forests.—*1. Private Forests.* Three-fourths of the area under wood in Switzerland are, we have said, under direct State control, the remaining one-fourth being the property of private individuals. But, under the exigencies of the state of matters which had been brought to light in the reports we have mentioned, private interests had to yield to the public good, even the proprietors were restrained from the selfish and inconsiderate use of their forests. They were prevented, in fact, from wasting their capital, to the detriment of others as well as of themselves. They could not, for example, cut down the trees on lands which were unfit for any other product, than that of wood. They could not fell the forests which were situated on steep slopes, the denudation of which would expose the neighbouring lands to destruction by avalanches or by floods. And the penalties for transgressing these rules were sufficiently deterrent, *viz.*, a fine of a franc for each square perch of land so laid bare, besides the obligation to place the land again under wood within not less than two years. Speaking generally, moreover, all operations in the woods, belonging to private individuals, required the sanction and supervision of the State Inspectors.

2. *State and Communal Forests.*—While these recuperative and restrictive measures were taken in private forests, strict regulations for the working of the State and Communal forests were peremptorily laid down, and rigorously enforced. Before going further, it may be well to have a distinct idea of what are meant by Communal forests.

We have seen that even private proprietors were not the absolute masters of their forests, or the sole judges of the way in

* Report to the Federal Council on the Forests of the Alps and the Jura.

which they should be managed. In a far stricter sense, was this the case as regards the forests nominally under charge of the Communes. These were, in fact, only the stewards, not the possessors, of their property. The regulations laid down for the management of the State forests, were in equal force in those belonging to the Communes, and the special duty of the State Inspectors with regard to the Communal forests, was to see that these rules were carried out, their particular care being, that in the annual fellings the "possibility" of the forests was not exceeded. This limit of "possibility" was annually fixed, and the trees to be felled, carefully marked, so that no plea of ignorance could possibly be urged. In short, all operations were conducted by the Communal authorities under the advice and direct surveillance of the State. Without such supervision the temptation to recoup the losses occasioned to the Communal treasury, in consequence of a succession of bad harvests for instance, by the felling of an undue proportion of wood, may easily be imagined. Our readers will thus understand that, what follows may be taken as applicable to both State and Communal forests alike.

General Principles of Forest management.—After the formation of a special department and the careful selection of the "personnel" of that department, there are three outstanding principles, which must govern the successful carrying out of the systematic management of the forests of any country.

These are *first*, the careful mapping out and distinguishing by recognised boundaries the reserved or State forests; *second*, the constitution of a "close time" for the cutting of wood and its removal from the forests; and *third*, the regulation of the rights or privileges of pasturage.

We shall now proceed to examine how these principles were insisted on, in the forest system of Switzerland.

1*st*. *The Demarcation of Forests*, as to the demarcation which must manifestly precede the other two. The marking out of the boundaries of the various forests, State, Communal and private, was no capricious or sudden act of an irresponsible department. It was rather a solemn function, of which due notice was given in the Official Gazette, made by a sworn "Commissary Surveyor" in the presence of a delegation of the Municipality, the Forest Inspector and the neighbouring proprietors. All rights were thus represented, and all reasonable objections were entertained and disposed of with as brief delay as possible, under the provisions of the Rural Code. The boundaries once fixed and recognised were carefully gone over at intervals not exceeding four years, in the presence of those interested, and exact and detailed plans of the various forests were prepared and kept in duplicate, one copy being deposited in the State Archives, the other being at hand for "field" use.

2nd. A close time for Forest operations.—The second principle, *i.e.*, the establishment of a "close time" for forest operations was laid down with equal exactness. No felling or working of wood of any sort, was permitted in the forests of the plains between the 1st of May and the 30th of September, or in the forests of the mountains, between the 1st of June and the 31st of August. A decree of the Council of State determined the forests which were included in either of these categories. An exception, however, was made in the case of oaks intended to be barked, which could always be felled in the month of May. The purchasers of wood sold either felled or standing, were not permitted to commence their work without the official ratification of the sale, and their authorised entry into the forests, no work whatsoever being permitted on Sundays, on days of religious or civil Feasts, or at night.

3rd. Regulation of the rights of Pasturage.—The third great principle, which we have laid down, is the regulation of the rights of pasturage. Here we have one of the most difficult, as it is one of the most important, matters of forest management. The rights of pasturage are not easily controlled, and cannot be entirely extinguished in any country without great abuse of power, and without inflicting hardship on the people. Those who know the tenacity with which all rights of commons are clung to in our own country, will possibly be surprised at the uncompromising nature of the provisions which regulated the exercise of this right; or to speak more correctly, this privilege, as it was considered in Switzerland. Not, however, that these provisions were any less strict than the exigencies of the case demanded. All those who have had anything to do with the rearing of trees, know how absolutely incompatible with the existence of plantations, is the admission of cattle. Recognising this incompatibility, the first general rule laid down was that, no animals of any sort were permitted in the plantations, or in any woods, where the trees were less than 15 feet in height. These parts of the forests were absolutely closed against pasturage.

Secondly, pasturage was not allowed in the Cantonal forests at all, or in one-fourth of the Communal forests of older growth than those above-mentioned. In the other three-fourths of the Communal forests, cattle were admitted from the 13th of May to the 31st of October, in the plains, and from the 25th of May to the 9th of October, in the mountains. Sheep and goats were not admitted to the forests of the plains at all, except in places where the soil was so rocky, as not to be capable of bearing anything but brushwood. The number of these animals, which each family was permitted to send to such pasturages, was fixed by the Municipality, who had to advise the Forest Inspector of the district of these permissions. If the demands were in excess of the areas, which could be opened to grazing, preference

was to be given to the poorest households. Independently of the above restrictions, the Council of State reserved to itself the right, absolutely to interdict for as long a period as seemed good to them, the exercise of any rights of pasturage at all, if the state of the forests of any Commune, appeared to demand entire rest.

General Laws and their enforcement.—The laws regarding the marking, cutting and floating of timber, the laws regarding its public sale by auction, the laws imposing fines on trespassers, &c., do not differ in any material respect from the general forest laws which are found to be necessary in all wood-producing countries, where timber is valuable. These need not be specially gone into here, except to note that the members of a Municipality or Commune were held individually responsible for any violations of the laws, and were personally punishable by fines for these, and fines always carried with them, besides their money value, the obligation to restore within a fixed time, woods destroyed or damaged by neglect, as well as by wilful mischief. The fines themselves, when they were incurred for contraventions of the laws in the Cantonal or private forests, were given to the Cantonal hospital. When the violations of the law were committed in the Communal forests, one-third was given to the Cantonal hospital, and the remaining two-thirds went into the Communal treasury.

Rights of "Usage."—There remains only to be noticed as a speciality of the system of forest management in Switzerland, the exercise of the rights of usage and their compulsory surrender or purchase for a sum fixed in proportion to their yearly value. These rights of usage, such as pasturage, turbage, &c., unless they were founded on titles, were at once suppressed. If they were founded on titles or otherwise justified by their possessors, they were declared purchasable by the payment of a sum equal to twenty times the mean value of the right, during the preceding 20 years. The working of this provision, which sounds strange to our English ideas, will be better illustrated by the following case taken from the official reports of one of the Cantons.

The Cantonal Tribunal, in its meeting of——has pronounced the purchase by the State of the right of usage affecting the forest of——in favour of Monsieur A. B. in granting him an indemnity of——francs or the choice of a piece of ground representing this sum. Monsieur A. B. having appealed to the Federal Council, the definite settlement of the matter is again deferred. In the report for the following year, we read a summary solution of the difficulty, under the provisions above alluded to. The Federal Council, having declared itself incapable of judging the appeal made to it by Monsieur A. B. concerning his right of usage in the Forest of——, the Cantonal Tribunal has proceeded definitely to settle the matter as follows:—Monsieur A. B. having volun-

tarily and formally refused from the State both the ground, and the sum of money allotted to him by legal judgment, *his right has ceased to exist.*

On properties where these rights of usage were intermingled, as for instance, on mountain holdings, where the forest appertained to one person, and the pasturage to another, the two interests could be divided at the request of one or other of the parties interested. In this way, the proprietor of the pasturage, would obtain a portion of the forest for his domestic uses, besides the isolated trees to serve as shelter for his cattle, while the proprietor of the wood, retained the surplus, and acquired a right of pasturage. If the parties could not agree over this interchange, arbitrators were appointed at the public expense. Here, the arrangements were very elaborate, and we may perhaps be allowed to detail them, as illustrative of the working of a Communal Government.

In the first instance, five arbitrators were appointed by the Tribunal, and their nomination notified to the judge of the place. Each of the interested parties was at liberty to challenge one of these five arbitrators, so that their number was eventually reduced to three. These having taken the prescribed oath, investigated first the titles, and then the lands in dispute. They thereon made an estimate of the annual value of the right, and determined the portion of the forest, which should be assigned in compensation for its surrender. Any appeal from the decision of the arbitrators was carried to the Cantonal Tribunal.

The general rights of usage to wood for the construction of new buildings, or the repair of existing ones, were exercised only under the special authorization of the Department of Agriculture and Commerce in Cantonal forests, or of the Municipality in Communal forests. In each case, however, the resumption of the right was reserved.

General observations.—We hope that we have made it sufficiently clear, that while all the above measures had in them a ring of autocratic, or, if our readers prefer it, democratic power, which would most certainly be resented in our own country, yet that the provisions made were so just in themselves, and so manifestly for the public good, and the good moreover of the Municipality or individual interested, that they provoked no resistance, and were acquiesced in with more or less heartiness. Indeed, it is one of the most pleasing features of the Swiss management of forests, to the contemplation of which we are led as it were by insensible, but still tolerably apparent steps, that the people of all classes are fully aware of the benefits resulting to the governed as well as to the Governors from the systematic management of their forests. True, it may be said, that arguing from the state of matters that existed previous to the strict enforcement of the laws, common sense would dictate a general acquiescence; but then we do not look, unless we are

of an unusually confiding disposition, for the display of common sense from nations, any more than from individuals. It is, we repeat, a pleasing feature of the system to observe, what is repeatedly recognised in successive forest reports, the hearty co-operation of the people, with the Inspectors of the forests.

We have written purposely in the past tense of the system as it was introduced or rather re-established after the consideration of the reports to which we have above alluded. The regulations, as they were then made, are still in force, and govern the principles of forest administration. Practically, however, as their beneficial results became apparent, it has been found possible and advisable to relax in some degree the provisions which are more individually repressive, such, for instance, as that restraining the liberty of action of private forest proprietors. The resumption, however, of each or all of them, in their entirety, at any time that may become necessary, is readily allowable by the existing authorities. It is equally allowable, therefore, for our readers, to read present for past in the foregoing observations.

Statement of Revenue, Expenditure, &c.—The success of the system may be gathered from the following tables, which may be taken as representative ones, representative that is, in respect of the years reviewed, which do not embrace either expenses or receipts of an unusual nature, representative also as being those of a Canton which is under vigorous forest administration. It must be noted, moreover, that while the financial results as detailed, have been achieved, the extent of the forests has not only been maintained, but has been increased, and all fellings carefully made good by replanting, while the interests have been accruing, the actual capital has been nursed and consolidated.

STATEMENT A.—CANTONAL FORESTS.

Receipts.

Heads.	1884.	1885.
	Francs.	Francs.
Sale of wood for the public service, ...	358,496	318,694
Wood given to usagers, ...	3,100	2,503
Sale of forest plants, ...	6,735	7,151
Sales of hay, &c., ...	7,042	7,592
Floating, ...	78	831
Casual receipts, ...	589	733
Francs, ...	376,040	337,504

Expenditure.

Heads.	1884.	1885.
	Francs.	Francs.
Establishment, ...	49,548	51,920
Laying out and extension of new forests,...	3,702	3,293
Plans and enclosures, ...	1,003	278
Plantations and nurseries, ...	15,945	21,955
Felling and transport, ...	44,695	43,899
Official notices, ...	1,607	1,214
Maintenance, &c., of roads, ...	51,805	17,002
Floating of timber, ...	791	829
Maintenance of domains, ...	1,669	1,399
Payments to "usagers,"	22,362	24,100
Value of wood to usagers, ...	3,100	2,503
Provision for receivers, ...	6,952	6,138
Extraordinary expenditure, ...	16,851	23,382
Francs, ...	220,030	197,911

Reducing this, for convenience sake, to pounds sterling, we find that, in 1884, the receipts were £15,040 and the expenses £8,800, leaving a net surplus in favour of the forests of £6,240. In 1885, the receipts were £13,582, and the expenses £7,917, leaving a net surplus in favour of the forests of £5,595.

We will not trouble our readers with a mass of figures relating to the operations conducted by the Communes. The forests in their charge naturally suffered most severely under the neglect of former years, and the restoration of the equilibrium between supply and demand has been thus less easily handled. The condensed statements (*a*), (*b*), and (*c*), given below, will show the manner in which this was set about, and the extent to which it has succeeded.

STATEMENT B.—COMMUNAL FORESTS.

(*a*). *Sowing and planting.*—In the year 1884, 990 kilos.* of seed were sown, and 2,025,800 young trees planted. In the year 1885, 530 kilos. of seed were sown and 1,976,960 young trees planted. These operations embraced an area of 104,735 acres, and were undertaken in view of the prospective requirements for timber and fuel.

* Kilo. = 2·204 lbs. English, say, 2 lbs. 2 oz.

(*b*). *Felling of forest trees for timber*—In the year 1884, 119,913 cubic feet of timber were felled, the "possibility" however being stated at 115,102. In the year 1885, 114,909 cubic feet of timber were felled, the "possibility" being put at 114,743. The felling therefore was in excess of the proper ratio, but in a lessening degree.

(*c*). *Felling of smaller trees for firewood.*—Here, as we might expect, the equilibrium was more easily restored, and the consequent conditions of the fuel reserves very healthy. In the year 1884, 11,800 arcs* of firewood were cut, the possibility being placed at 14,532 arcs. In the year 1885, 11,059 arcs were cut, the possibility being placed at 14,623 arcs. The supply was thus officially stated to be in excess of the demand.

STATEMENT C.—PRIVATE FORESTS.

In the year 1884, 304,880 plants were sold to private proprietors from the Government nurseries for the purpose of reafforestation. In the year 1885, the number of plants sold was 264,195. This brief statement illustrates the manner in which the State encouraged the extension of private enterprise, *viz.*, by the sale of seed and plants at a price considerably below their market value.

A TOUR IN THE SALT RANGE.

WHEN exploring for coal in 1885, I discovered a bed of fossils which caused surprise because the fossils (chiefly species of *Conularia*) were pronounced by the Geological Survey to be of carboniferous age, and yet the strata in which the bed occurred had hitherto been considered as cretaceous.

It was thought that an examination of the rocks further west might yield the required information. This expectation was amply realized. I found pebbles with the same fossils in crystalline boulder beds at a new place (Nila Van) underneath the speckled sandstone. (See A. B. Wynne, Memoirs of the Geological Survey of India, Vol. XIV., 1878, page 90, No. 5). The speckled sandstone underlies carboniferous limestone, and it follows with certainty that the crystalline boulder bed, in which the pebbles with carboniferous fossils occur, is all one and the same and of carboniferous age, as argued by Dr. Waagen in the records of the Geological Survey of 1886.

* Arc = 100 square metres, the metre being equal to about 3 feet 3¼ inches = 3·281 English feet.

I extended my journey to Varcha, about 63 miles from the Mayo Salt Mines, and found the crystalline boulder bed just the same as eastwards. The character of the boulders is the same, and some of them show glaciation.

As I had before this found several crystalline boulders and pebbles in the Eastern Salt Range, not only simply ice scratched, but faceted on all sides by the agency of moving ice, there is no doubt that the whole crystalline boulder bed in the Salt Range is derived from a carboniferous glacial period.

This is a fact of importance in its bearing on the Indian coal measures generally. It has also been argued by Dr. Waagen, the Palæontologist, that the glacial crystalline boulder beds of the Salt Range are very likely of one period with the similar beds in the Talchirs, which underlie the true Indian coal measures. With regard to the Salt Range, his suppositions were proved correct; as regards the Talchirs of the Indian coal measures, proof is still wanting.

The Salt Range extends from east to west a distance of 125 miles, across the Sind-Sagar Doáb between the rivers Jhelum and Indus. It rises to 2,000, 3,000, and in one case to 5,000 feet above the sea. It derives its name from the extensive deposits of rock salt. In addition to the rock salt, there is also coal. Compared with the salt, the quantity of coal is very small still, a workable area has been found, and a colliery has been established (Dandot). The Salt Range is of great importance geologically, and highly instructive.

Salt of an older palæozoic period forms the base, and above it follow palæozoic glacial beds, carboniferous limestone, mesozoic strata, then the coal with a variety of tertiaries. The whole series of sedimentary strata is thus represented, and the number of fossils is very great.

The coal of the Salt Range has nothing to do with the true Indian coal measures of the carboniferous period.

The carboniferous rocks of the Salt Range are principally of marine origin. Only traces of coal occur in them, and never any real seams. The coal of the Salt Range underlies the eocene (nummulitic) limestone. About 500 square miles of the limestone form the plateau of the Range, and in several places good coal is found cropping out underneath.

In some instances, the excavations showed the coal unfit or too thin for profitable working, but the exploration, in 1886, disclosed a sufficiently extensive portion of thicker seam under the small plateau of Dandot. On this, the Dandot colliery has been established.

The field is an approximate square with sides of two miles length. Along the whole south side, the coal has been proved continuous 3 feet thick. On the west side, it thinned out to 10 inches, and towards the centre, a bore hole proved 18 inches of coal at 340 feet depth. On the east, 5 feet thickness of good

coal were proved about a mile away from the Dandot plateau, and lately, one new drift disclosed the coal 3 feet thick, on the eastern edge of the Dandot plateau itself. Some other drifts on the south scarp were continued in the coal several 100 feet underneath the plateau, and apart from structural irregularities, the coal has kept on well, and improved in quality with the progress into the interior.

A supply of one million tons has been estimated in the plateau, and what progress there has been in excavation corroborates this estimate, as a safe one.

A main low level entrance has now been started, and the mining is to begin in earnest, after the colliery has been completely connected with the line of railway. A branch line on the broad gauge about three miles long will be completed in a few months from Keorah (Mayo Mines) Station, to the foot of the Dandot hills. From the foot of the hills, to the colliery, a tramway is under construction with steep inclines, on which the descending loaded trucks pull up the empty ones by means of wire ropes. Including this tramway, the total length of the connection with the Keorah Station will be about 5 miles. The removal of the coal will thus become very easy.

The excavation of the coal beneath about 400 feet of superincumbent limestone and alluvium will be a more difficult task. It is to be hoped that when the full working takes place, the loss of life through the breaking down of the roof may be prevented. A liberal expenditure on supports and on filling material from the outside is advisable.

At the time of my visit, the actual outturn of coal was only 300 tons a month. It is of course expected to rise much higher after the opening of the whole Sind-Sagar Railway and the completion of the bridge across the Jhelum river at Chak Nizám.

The Forest Department receives a royalty of 4 annas for every ton of coal raised.

The Railway is at present the only consumer of coal, but a demand for coal may arise for other purposes.

That the coal-bearing strata extend over a very much larger area is known on geological grounds. The question is, how far the seam continues thick enough for working. Chittidand, near Dandot colliery, was found to have a thick seam, but the area over which the full thickness kept on, was not sufficient.

Other places showed the seam only 8 to 12 inches thick, but one (Tid) on the other hand has 5 feet. I have little doubt that places exist under the main plateau with areas of thick workable seam as extensive as the Dandot working area, but it would require careful and thorough exploration to find out such sites, and none could at present be more conveniently situated for railway communication than Dandot. A large salt mine (Mayo Salt Mines) and a colliery for the railway

being both situated on a branch of only 10 miles length is very favorable.

I visited also a seam of bituminous shale in the Nila Van, 25 miles due west of the Mayo Salt Mines. The seam occurs in the gypsum which rests on the rock salt. The seam is 6 inches thick, not enough to repay excavation. The shale burns with a long smoking flame, and would no doubt yield a large proportion of oil by distillation. Traces of such shale were also noticed near the Mayo Salt Mines, and on a former occasion I distilled some oil from it (A. B. Wynne's Memoir on the Salt Range, page 75, footnote). The following is the analysis of some of the shale made at Dehra Dún :—

Bituminous shale from the gypsum above the rock salt at Nila Van in the Salt Range—

Ashes, ...	62
Fixed carbon, ...	13
Oil, ...	13
Water and gases, ...	12
Total, ...	100

Specific gravity of the shale = 1·3.

The ashes are white.

It is well to draw attention to this shale. A thicker deposit might exist: if not in the gypsum above the rock salt, there might be more below the rock salt.

The rock salt is the lowest known rock of the Salt Range, and no strata underlying the rock salt have as yet been ascertained *in situ*, nor have any sinkings or borings been made to find out what is below the salt.

The beds of gypsum overlying the salt form one continuous band nearly along the whole Salt Range, and the salt itself may also be nearly continuous. At the Mayo Salt Mines, no less than 600 feet thickness of saline rock are known, and about half of the thickness is pure salt fit for human consumption. At other places, the salt is thinner, sometimes only 10 or 20 feet of pure salt being visible. In the absence of excavation, no general estimate can be made, but so much is certain that the supply of rock salt in the Salt Range is literally inexhaustible.

A large amount of salt is actually exposed on the surface, particularly inside of the deep gorges, which cut through the high southern escarpment of the Salt Range. On the right bank of the Indus, near Kálabágh, there is enough good salt exposed for the supply, by mere surface quarrying, of 1,00,000 maunds a year to the Government Salt depôt there (1 maund = 82⅔ lbs. English). The larger quantity, about 12,00,000 maunds a year, which is issued at the Mayo Salt Mines could not be conveniently obtained by quarrying, and seams from 50 to 150 feet thickness are worked underground. The seams are inclined, and the excavation proceeds in regular parallel chambers 45 feet

wide, 100 or 200 feet high, and limited by the width of the respective seams. Pillars or walls of rock salt 25 feet thick intervene between the chambers and bear the weight of the hill, which is about 400 feet high. This system is in force since 1872, and a considerable underground space has resulted. There is one chamber 200 feet high, 200 feet long, 45 feet wide, which just represents the whole output of one year, so much salt having been eaten by 15 million people in a year.

The mine is provided with a tramway, 2½ feet gauge, which is working since 1873. The tramway leads from the interior of the mine to the Kheorah Station of the Sind-Sagar line one mile from the mouth of the mine. The cost of production is less than one anna per maund, so that the imposed duty of Rs. 2 per maund is almost entirely clear revenue to Government. Any amount of salt might be removed unlawfully from the natural salt outcrops, and sold at a very profitable rate, if precautions were not taken. There is a large establishment under the North Indian Salt Revenue Department, and about 500 of the men with their officers (Superintendents North Indian Salt Revenue) are occupied in guarding the natural salt outcrops of the Salt Range. A practise exists of surrounding these outcrops with fences of branches and thorns as a protection against intruders, and of late very great energy has been shown by the Department in this respect. Officers try to get as much fencing work as possible done by their men, and thus, the extensive salt outcrops in their charge are surrounded by double or triple fences of branches. The branches are hacked off the nearest struggling shrubs and small trees, chiefly the thorny *Acaria modesta*, and it may be imagined how much material is required for many miles of outcrop, and how much damage can be done by several hundred men thus let loose upon ground, where a much needed scanty growth of shrubs and trees is struggling to maintain itself on steep rocky slopes in a hot climate with, at the most, 16 inches of rainfall.

The worst is that the fences once made do not remain. A great many of them are eaten by white ants or washed away by sudden floods, and have to be renewed from year to year. It is a pity to see so much injury thus done to the trees, on a hill area which has very great need of vegetation.

Not only is the material procured in a most reckless and destructive manner, but I can affirm that the whole object is a mistake. One might as well think of keeping thieves from off a treasure chest by placing thorns round it, as of keeping salt smugglers from the salt outcrops by means of these fences. Thieves can always make a way to the outcrop by removing the thorns, and the establishment then put the thorns back again. As a check on the watchfulness of the establishment the fences are thus no good either.

The surface of the outcrops themselves is the only real check

against undetected theft. The area of the outcrops should be kept free from loose and projecting pieces, so that any removal of salt can be traced afterwards by the injury done to the surface. If mechanical means are desired to keep the thieves off the salt, there are many other more appropriate means than the thorn fences. Old mines can be closed, craters filled, old salt heaps removed, areas rendered inaccessible by cutting away pathways, and in special cases walls can be constructed. All this is far more permanent and useful work, and not injurious, as is the destruction of the trees on the steep slopes and sides of the gorges.

The abolition of these thorn fences round the salt outcrops, mines, &c., in the salt gorges is a most desirable step. Without this abolition, all the endeavours to improve the growth of vegetation in the salt gorges and their neighbourhood are useless.

The Salt Range generally is in a frightful state, as regards the protection of the hill-sides by trees. To give an idea of the comparative barrenness of the area, I made a rough estimate of the quantity of fuel available, if every existing tree and shrub in the whole place would be cut down to the roots.

I estimated the amount thus supplied—

(1), in the forests protected against grazing since 15 years or so.

(2), in the protected forests, in which grazing continues, including the salt gorges.

(3), in the villagers' own waste lands.

			Fuel per acre.
In No. 1,	...	...	200 maunds.
In No. 2,	...	...	20 „
In No. 3,	...	...	2 „

These figures are not intended to be accurate. They are mere approximations, in the place of still more vague verbal descriptions.

In many places near villages, there is literally nothing left but a scanty growth of grass between the stones and rocks, unless the very soil even is gone and the bare clean rock exposed.

Some flats and depressions on the plateau and sides of the Salt Range are filled with alluvial soil and serve for cultivation. Some fields obtain an irregular supply of water from the surrounding hill-sides. The larger areas are grazing grounds, which would be so much the better for a growth of trees.

There is excessive wind blowing all over the Salt Range. It is no doubt largely due to the absence of tree vegetation. Wind-mills for raising water and grinding corn would be very suitable at many places on the plateau, but none exist. If only one wind-mill could be erected as a pattern, others would follow suit.

In comparison with the injurious climatic effect of several hundred square miles of bare surface in the Salt Range hills

and neighbourhood, the damage done by the occasional torrents in the great gorges of the Salt Range is inconsiderable. They carry sand and salt out into the plains to the south between the Salt Range and the river Jhelum. If the flow would be more regular it could be used with more benefit for the fields, and some measures could also be adopted to diminish the absorption of salt by the rain water from the outcrops.

The Salt Department is really in a position to render most valuable service in the protection of the forest grounds all over the gorges where their guard-posts are. Five hundred men stationed over the forest area could easily afford absolute protection to the tree growth. If the Salt officers could be interested in the matter, a most efficient aid would result.

One of the officers of the Salt Department (or more correctly North Indian Salt Revenue Department) told me that he intends to apply for permission to attend the theoretical course of the Dehra Dún Imperial Forest School for one season. If this be granted to him, others would very likely follow. A course of natural science would be of benefit to all those officers of the Salt Department who have charge of mines, salt lakes or salt manufactures. They might attend for three months, and obtain leave for the purpose just as if they had the usual language leave.

H. WARTH.

EARLY DAYS IN ASSAM.

MY first experience of the large game of Assam dates from a very remote period. I was then about 6 or 7 years old, and my father was Surgeon of an Irregular Corps, called the Second Assam Sebundies, commanded by Major P. Mainwaring. The head quarters of the Regiment was at Rangagora, a military station in Upper Assam, which was abandoned many years ago, and the site is now a thriving tea garden. The Regiment itself ceased to exist about the time of the abandonment of the Cantonment, but at the time of which I am writing, Rangagora was a busy little Military Cantonment, newly established and requiring a great deal of jungle clearing and house building to make it inhabitable. There were immense wastes in all directions, teeming with game of every description. My experience was, however, limited in the matter of sport to witnessing the shooting of a splendid wild buffalo, which came about in this way. The people of the country were utter savages, and the milking of cows was unknown. Buffaloe's milk was however procurable, and in order to obtain a permanent supply for a somewhat large family my father invested in four milch buffaloes. These animals were a great source of delight to my brother Tom, who was about four years older than myself. He became quite expert in riding and guiding them. They were magnificent beasts, much bigger than

the attenuated race of Bengal buffaloes, since introduced into the Province. They had fine horns, the smallest of which were not under 9 feet from tip to tip—dimensions almost unknown now among cow buffaloes in Assam, owing to the admixture of the puny Bengal and North-West species. To return, however, to our small herd at Rangagora, the beasts behaved remarkably well for some months. Milk was abundant in the household, and there was more butter than we could well consume, but everything is fleeting in this sub-lunary sphere, even the supply of buffalo milk, and one morning we were surprised and grieved to learn that our small herd of buffaloes had eloped, taking their calves with them. From enquiries made it was ascertained that they were last seen in the company of a stalwart bull buffalo, a good specimen of the genuine wild race. He had apparently persuaded our buffaloes to exchange their life of servitude for one of freedom. No one dared to interfere, as the cover was thick, and it was not devoid of danger to follow him and his new companions into the forests. We were thus reduced to a milk famine, as the villagers were unable, at a short notice, to supply us with any. Fortunately the buffalo keeper ascertained in a few days that the runaways were in the habit each afternoon of taking a siesta on the sands at a bend of the Debrú river, some few miles from the station, while they spent the remainder of their time in dense and unapproachable cover. Being satisfied of the correctness of the information, my father obtained the use of a dugout with two rowers. He carefully loaded a muzzle-loading 12-bore gun, and with a small supply of ammunition sallied forth to recover his property. My brother Tom accompanied him of right, but I had considerable difficulty in being allowed to join the party, though on promising to be very quiet, and sit well inside the dugout, I was permitted to enter it, and we rowed away on our expedition with the good wishes of all who saw us off from the ghát. The river was by no means a broad one, neither was it very deep throughout its course. At some points it was shallow enough for a man to wade across; on both sides there were dense forests and undergrowth relieved only at the bends by small spots of sand fringed by grass jungle. We rowed down silently for nearly an hour, the river being very tortuous. At length the herdsman who accompanied us whispered to my father that we were approaching the spot where the wild one and the runaways were in the habit of disporting themselves. My father at once saw to the caps on the nipples of his gun, and got ready for the emergency. Another turn of the river brought us full in view of the happy party. They were all lying on the warm sand thoroughly enjoying themselves. A slight noise made by one of the rowers at once aroused the vigilance of the wild bull, and he sprang to his feet and advanced towards the boat, which was then in a remarkably shallow part of the stream; my father covered him with

his gun, and as the brute showed signs of following us into the water, he fired and hit him about the right temple. The brute at once charged into the stream, which was not more than knee deep, and dashed at the boat, but as he approached my father fired again at close quarters into his shoulder, this quite sickened him, and he swerved from his charge, bounding across the stream in a few plunges instead of returning to his companions, who remained motionless all the time. My brother no sooner saw the wild buffalo on the opposite bank than he jumped into the river, and wading on to the sands to where the tame buffaloes were. He soon secured the principal one, and the herdsman securing another, the other two with all the calves followed, and we returned in triumph to cantonments.

The riders of the buffaloes finding a short cut by the river bank, next morning, my father sent a tracker to follow up the spoor of the wounded wild buffalo, and it was found dead within a few yards of the bank, the second bullet having gone very near his heart. His horns were magnificent, and long remained a family trophy. As a matter of course the milk famine to our great delight ceased at once.

My second direct acquaintance with the habits of big game was acquired about two years subsequent to the above narrative while I was still a lad. It impresses itself chiefly on my memory by reason of its being connected with two points which have been often discussed by sportsmen, and in regard to which divergent views are frequently held. The first of these disputed points is whether a tiger will break into a house to kill its prey, although it cannot see it, and the second is, whether the "phaiho" is an ordinary jackal, or a distinct species of animal. I think the story which I am about to relate, although it may be disappointing in having nothing exciting about it, will effectively set at rest the above two points.

We had left Rangagora on the disbandment of the Second Assam Sebundy Corps, and my father was posted as Civil Surgeon of Sibsagar, which at that time was rather jungly, although it is now a centre of civilization for tea gardens. All the civil buildings and residences of officials in those days were constructed on the banks of a very large tank about half-a-mile square.

The banks were formed no doubt with the earth taken from the tank when it was dug, supplemented by the excavations from a moat, which at a distance of some hundred yards ran on all four sides of the banks of the tank. My father owned a plot of land on the bank of this tank, which now forms the site of the circuit bungalow. He had built a rather comfortable bungalow with out-offices close by, and among these was a fowl-house, which also afforded accommodation for a milch cow. The walls of this building were of plaited reeds, well plastered with mud, and they were strengthened on the inside by bamboos

split in halves to keep out jackals. One evening about 9 or 10 P.M., while we were all gathered a round a wood fire in a large iron pan in the drawing room, the house not being provided with a chimney, we heard a continuous barking of dogs outside, intermingled with the shrill cries of the "phaiho." We were not unaccustomed to these noises, but on this night, they seemed much louder than usual. At length we heard a great commotion in the fowl-house as if the ducks, fowls and geese were all clamoring to be released. My father who was engaged reading at the time, turned to my brother Tom, and bade him take a lantern and go and see what occasioned the noise. My brother hastened to obey, but in a few minutes returned with a very scared face, and stated that as he attempted to open the door of the fowl-house, he was greeted by a terrific roar inside, and that the whole building shook as if it were about to fall on him. My father at once caused torches of thatching grass to be lighted, and we advanced to the fowl-house. On opening the door a ghastly sight awaited us, our favorite milch cow lay quite dead with blood gushing in torrents from its neck. It had of course been killed by a tiger, which we observed had effected an entrance by tearing away the reed walling and bamboo fence on one side of the house, and had effected its departure by bursting through them on another side, when it was disturbed by my brother, who fortunately had taken a lantern with him, the light of which no doubt frightened him away from the prey, which he had just killed.

It was not possible to do anything beyond hastily closing the huge aperture, which the tiger had made in the walls, by tying a few bamboos across them securely. We then shut the door, and betook ourselves back to the bungalow, feeling greatly relieved when we found ourselves in comparative safety inside, for although the walls were only of lath and plaster, we felt sure that he would not endeavour to enter so large a building, besides, as he was not apparently a man-eater, he would have no inducement. It has puzzled me since that he made no attempt to interfere with us while we were engaged in repairing temporarily the damage which he had done to the fowl-house walls. We noticed from his impressions on some soft ground next day, that he must have watched our operations from a bush about 40 or 50 yards off. During the whole time the "phaiho" kept up their monotonous and weird cries, and the dogs continued barking at a safe distance. I fancy the blaze from the torches of thatching grass must have kept the tiger off. For some hours after our return to the bungalow, and after we had retired for the night, the cries of the phaihos in the immediate neighbourhood of the bungalow were kept up, but to our great relief, they gradually withdrew to a distance towards morning, in the direction of a jungle beyond the moat which surrounded the banks of the tank.

As soon as daylight appeared we hastened to inspect the scene of the catastrophe, and found from his foot-prints that although the tiger had apparently been several times round the fowl-house after our visit to it, and had obliterated the foot-marks which our party had made in repairing damages, that he had been unable to muster sufficient determination to re-enter the building, although the body of his newly killed prey was inside, and he had had no time to eat any portion of it. I think the incident a remarkable one, as during my long and varied subsequent experience of the habits and customs of tigers, I have never known of a single instance in which they have broken into a substantially walled house, for the purpose of killing their prey. They have been frequently known to enter cow-sheds and take away one of the herd, but in all these instances there were either no walls to the sheds, or the walls were of bamboo rails through which the animals inside could be seen distinctly. I cannot also understand why he did not repeat his visit to the house to devour his prey. The natives affirmed that as tigers are very cautious he may have dreaded that a trap had been laid for him, when we visited the place and repaired the breach he had made.

On the following evening about 4 P.M. our servants raised a cry that the tiger was in sight, and to our intense astonishment we saw the huge brute walking leisurely along a road which skirts a moat extending all around the Sibsagar tank. He was certainly not more than 300 or 400 yards from where we stood in front of our bungalow. Two jackals followed him at a short distance, uttering at intervals the weird and piercing yell known as the cry of the phaiho. The tiger kept sauntering along quietly without noticing them apparently; at length he squatted in the middle of the road, and looked benignantly in our direction. We maintained a respectful quiet lest he should be irritated by being shouted at, in which case a few bounds would have enabled him to clear the moat and be amongst us. The only gun my father possessed was out of repair at the time, but even if it had been available, it would have been very risky to have attacked the brute on foot. I believe, however, his intentions were not hostile, as he appeared to be in good humour, and by no means bent on mischief. After a while he resumed his leisurely walk along the road. The phaihos still maintaining their shrieks, and following him at his own pace; at length he stopped suddenly and facing the jackals chased them for about 20 or 30 yards, beating out savagely with his fore paws once or twice, when he thought he had them within his reach, but they were far too nimble for him, and soon distanced him; when he again sat down on his haunches and glared angrily at the jackals, who now being quite safe continued to cry with greater rapidity than ever. The tiger remained in sight on the road till it was quite dusk, when we saw him enter a patch of grass bordering a paddy field, from which place it appears he sallied forth during

the night, and killed and ate a confiding pony which had come to graze on the paddy. He appears to have removed to some other locality after this exploit, as we neither heard nor saw anything more of him.

SENEX.

WALL-PICTURES TO ILLUSTRATE THE MINUTE STRUCTURE OF PLANTS.

SIR D. Brandis has presented a beautiful set of colored and shaded diagrams, illustrating the minute structure of plants, to the Forest School, Dehra Dún, and the following introduction to his description of them will interest our readers :—

Major F. Bailey, the Director of the Indian Forest School, some time ago suggested to me to send to Dehra Dún a collection of large-sized illustrations to be used in the Botanical teaching at the Forest School. This suggestion I discussed with Dr. Eduard Strasburger, the Professor of Botany in Bonn University, and he has kindly made a selection for me from the illustrations which he uses in his lectures, and has, moreover, superintended the copying of them. Some of the illustrations are taken from the published works of other authors ; the majority, however, are enlarged copies of drawings made by Professor Strasburger himself, some published, some as yet unpublished. Ten plates have been taken entirely, and a few more partially, from the work "Wandtafeln für den Naturwissenschaftlichen Unterricht, Pflanzenkunde" by Kny.* In some of these, important corrections have been introduced.

The numerous discoveries made by Professor Strasburger in anatomical and physiological Botany, as well as his excellent work "Das Botanische Practicum," Jena, 1884, are probably known to Botanists in India. For the information of the students at Dehra Dún, I may add that he is now one of the leading authorities in this branch of Botanical Science. An English translation of an abridged edition of his "Botanisches Practicum" is expected to appear ere long.

While I am indebted to Professor Strasburger for the selection of the illustrations, I am alone responsible for the explanations. In framing these explanations in English, I have to a great extent used the terms employed in George Lincoln Goodall's "Physiological Botany" (second volume of Asa Gray's "Botanical Text-Book"), New York and Chicago, 1885, and in Bower and Scott's translation of A. de Bary's "Comparative Anatomy," Oxford, 1884.

The illustrations represent the more important points relating to the histology of phænogamous plants. The teacher should

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* Abbreviated in the notes.—Kny, Wandt.

consult several plates for the representation of one object. Thus he will find the protoplasm and cell-nucleus represented on plates 2, 3, 5, 6, 8, 11, 24; starch grains on plates 4, 5, 21; intercellular spaces on plates 1, 5, 22, 25, 26; and ducts on plates 9, 14 to 19, 21, 22, and 28.

To the list of plates I have added a few notes in order to draw attention to some important points. I have also given references to the best recent works upon the subjects illustrated by the plates. I could not have undertaken to enter into anything like a complete explanation of the plates. This would have assumed the shape of a book.

I have read with the greatest satisfaction the periodical accounts of the progress made in the Forest School, which have appeared in the "Indian Forester" and elsewhere, and I was pleased to see that, in the first year's theoretical instruction, Vegetable Physiology, including the structure of wood, occupies the first place. In undertaking the present work, my wish was to facilitate the teaching of this subject. The time allotted to the course of theoretical instruction at the Forest School is necessarily short, the science of anatomy and physiology of plants is exceedingly large, and the indefatigable researches of numerous workers in Germany, France, and Great Britain, as well as in other countries of Europe and America, are developing and enriching it steadily. Hence in organizing the teaching at an institution like the Forest School at Dehra Dún, the aim should be to make a good selection of subjects. Unless this is done in a methodical manner, no satisfactory results can be attained.

Hence, in the present work, I have confined myself almost entirely to phænogamous plants, and my sole aim has been to facilitate a good understanding by teachers and students of a few leading points. *First*, the different descriptions of cells and their arrangement in tissues—epidermis, parenchyma, and fibro-vascular bundles. *Secondly*, the arrangement of tissues in roots, stems and leaves. *Thirdly*, the chief organic substances which are necessary for the life of these plants.

I wish to seize this opportunity to state my opinion strongly that the students at the Forest School will not be able to grasp the leading facts of anatomy and physiology of plants without a good knowledge of some portions of Organic Chemistry and of Systematic Botany. Further, that Chemistry, in order to be fully understood, must be practised by the students in the Laboratory, and that the teaching of Systematic Botany must aim at giving them a good practical knowledge of the trees and shrubs of which the forests are composed. Here, again, a good selection of subjects is essential. Such a selection is practicable, and upon the greater or less skill with which this selection of essential points is made, the greater or less success of the teaching at Dehra Dún will depend.

The present work is restricted to a few of the most elementary and most important matters in regard to the anatomy of plants, and yet at every step almost we stumble upon questions not yet finally settled and matters not yet cleared up. In my notes I have been carsful to draw attention to a few of these doubtful points. And yet the matters to which the present work relates have been the subject of research and experiment by a large number of eminent Botanists during the present century. In most cases, the plants of Europe with which these Botanists were perfectly familiar have furnished the material for these researches. New and unexpected discoveries are being made constantly at the present time. I have no greater wish in connection with this work than that the plates and the suggestions which I have thrown out in my notes may induce some of the professors and students at the Forest School, and Foresters in India generally, to commence independent researches on botanical questions with or without the microscope.

How much may be done to correct errors and to make discoveries, even in those matters which are believed to be firmly established, is shown by the excellent work done by some of my former colleagues in India, in order to determine with certainty the time required to ripen the seeds of the deodar and *Pinus longifolia*, and to correct the errors into which I had fallen when writing the "Forest Flora of North-West and Central India." The plates of the present work and my notes may contain many imperfections, and it will be a satisfaction to me to learn that an improved edition has been prepared by Indian Foresters. In an Indian edition, the material ought to be taken from Indian trees and plants.

To my mind, the most satisfactory feature in the Dehra Dún Forest School is that it has been established and is maintained for the Natives of India. Through the influence of this institution mainly, we must hope that Forestry in India will become naturalized, and will cease to be an exotic plant. When the organization of Forest Ranges has been completed, there will be more than 1,000, perhaps more than 1,500, Forest Rangers in all India, and the Forest School will thus exercise its influence on a large scale, and perhaps several such institutions will then be formed. The teaching of practical professions, which are based upon science, and which are connected with the land, like Agriculture and Forestry, is, I feel assured, destined to accomplish great things for the welfare of the people of India. Wall-pictures are often mounted upon cardboard to hang up. The arrangement adopted by me is, I believe, preferable in the present case. They are fastened with drawing-pins upon a blackboard, or wherever they may be wanted.

BONN,
May 1886.

D. BRANDIS.

FORESTRY AND FOREST ORGANIZATION.

With the object of keeping the ball rolling I venture to give some of my views on the above subjects.

Some of the remarks of "Veteran" deserve special attention. That when deciding important forest questions, such as grazing, settlements, working plans, &c., the principles of forest science should go hand in hand with that of general utility. Forestry in India is still in its infancy, and more harm than good has sometimes resulted from hurrying on measures from a purely scientific point of view. Also, as the trained men from France and Germany will probably themselves admit, they have to apply their Forest School knowledge with great caution, and on many occasions it may happen they are unable to apply this knowledge. I speak entirely with reference to the forests in the *plains*.

Perhaps some student from Nancy would inform us of the number of square miles of forests on the average which a French Forester of the superior grade has to take charge of. Is it as large as an ordinary Ranger's or Forester's charge in India? Say about 100 square miles? Whereas a Forester of the superior grade in India has often to hold charge of the forests in several districts having an area of considerably over 1,000 square miles, to say nothing of the extent of ground he has to get over to visit the various scattered forest ranges. And it must be remembered he has to work single-handed and supervise every kind of work; and with reference to the District forests (2nd class reserves, &c.,) he has to work with low paid duffadars, men on Rs. 10 and Rs. 15 per mensem, whose charges are often over 50 square miles. The wonder is that the Department gets the work done at all well with such raw material.

Then again with regard to working-plans—is there not too great a "push" being made at present; and when such have been drawn up in some cases it may be found they cannot be worked—partly from want of a regular and constant demand for produce, and partly from want of a competent staff to carry out the plans if they are at all elaborate.

Also, it should be remembered that a very large proportion of these forests are extremely poor, and what trees they contain are, as a rule, under 2½ feet in girth, and thus it follows that the main item of revenue comes under the head of grazing.

I think "Veteran" has made a mistake in his remarks regarding Cooper's Hill College. Indian Forest officers at present, and for many years to come, have to be first good *administrative officers* and then *Foresters;* they are also in need more or less of a judicial training. So that these officers should be as well educated as those in any of the other State departments. Cooper's Hill will afford such a training together with a course

of education in Forestry. Afterwards it can only result from many years of constant work in the Indian forests that a Forester can grapple with the many practical questions at issue.

There should be a good future in store for the Indian Forest Department, and its chief Conservators should be placed on a par with the heads of other departments under the Local Governments; but this can only take place when the Forest Department shows itself worthy of such confidence; and the best guarantee for such a future is that it should get the best educated officers having a bent for Forestry, such as Cooper's Hill College or some such institution *only* can supply.

A. J. C.

18th February, 1887.

FOREST DENUDATION IN TIHRI GARHWAL.

My reason for wishing to "appear in print" is only because an outsider's version of the destruction of forests by irresponsible persons may have the effect of bringing the value of forest conservation more prominently before the public.

We (my brother and I) view with the greatest alarm the possibility of the resumption of the leased forests bordering on the Dún by the Tihri Raja, as we know how his hill forests have been destroyed near Mussoorie. To begin with the east of Mussoorie and Landour. During my time, the forests between Landour and Kowdia Gulla beyond Dhunoltie have been all cut—for what?—a few hundreds of rupees paid by potatoe cultivators. The trees were allowed to rot or burnt into charcoal at the immensely remunerative rate of Rs. 4 per kiln of 200 maunds, this being the amount of the royalty charged. I saw some of the gigantic trees rotting on either side of the road, in 1882, years after they had been cut to let the potatoes grow. What benefit did the Raja get? I do not think he can have been enriched by a total sum equal to what he would be getting now yearly, if the forests had been judiciously cut, and wood and charcoal supplied to Landour and Mussoorie." In the meantime, the forest has been destroyed—25 miles in length and 2 miles broad.

To the north of Mussoorie, along the Chakráta road, as far as Sainjí village, the only "scenery" left, where there was good forest, are ghastly lime kilns. To the west, Benóg, once a beautifully wooded hill, is denuded of almost every tree, and only saved from utter destruction by the Municipality discovering it was within Municipal limits. Now it is being preserved, but it will not be worth anything for many years. Beyond Benóg hill, and further west, the most beautiful oak forest I ever saw was in two years turned into charcoal, for I believe a total sum of Rs. 200, paid to the Raja's people. The ground on which this forest was, is gradually being cut up by landslips, where no

forest will of course grow again. Again, beyond Benóg and to the south-west on the Bhudráj Hill, the Raja's boundary is clearly marked, where Shib Rám's land ends and the Raja's begins, as clearly marked, as the western boundary of the Landour Cantonment. In both these cases, the forest ending marks the beginning of the Raja's territory, which is encumbered with grass only! I mentioned Shib Rám, he is a most enlightened native, and does a lot for preservation of forests.

As a result of this wholesale destruction, the hills are being cut up by landslips, and the price of wood and charcoal has doubled within the last five years, and is yearly rising. Some effort is really necessary, for the good of the station, to stop this destruction chiefly in the Raja's territory.

To show what can be done with ordinary trouble only, we may mention that we burn some 25,000 maunds of wood yearly from our own forests, and will burn 50,000 maunds soon without it being possible for any one to say we are doing any harm to the forest. In fact we are the only people who have any extent of forest in Mussoorie.

1st February, 1887. VINCENT MACKINNON.

The Municipality of Mussoorie, and indeed all our Hill Station Municipalities, should have a good Forest Ranger in charge of their forests and plantations, and the visitors' jampánis who search the hill-side for grass and dead wood should receive permits, and, generally, some attempt should be made to preserve the beautiful aspects of nature, in these health resorts.—[ED.]

PUBLIC SERVICE COMMISSION.

WE see from a resolution of the Government of India that a Sub-Committee of the Public Service Commission is now to enquire into the admission of Natives of India and of Europeans to the various branches of the Public Service of India, including the Forest Service.

The Sub-Committee will be composed of certain members of the Public Service Commission, with the addition of professional colleagues, to use the words of the resolution.

"It has therefore been decided with a view to distribution of labour and the utilization of local knowledge, that the enquiry relating to the special Branches of the Public Service enumerated in the preceding paragraph shall be conducted by a Sub-Committee consisting of six members, one of whom, Sir Charles Turner, C.I.E., will also be President of the Sub-Committee. With him will be associated the Honourable J. W. Quinton, C.S.I.; and the Hindu, the Muhammadan and the Eurasian members of the Commission, for such period as may

be devoted to the enquiry in the Province to which they belong. As the Public Service Commission does not contain a Muhammadan member from Madras or Bengal, nor an Eurasian member from Bombay or the North-Western Provinces, the Local Governments of those Provinces will nominate as local member of the Sub-Committee a Muhammadan or Eurasian member as required. Finally, each Local Government will be requested to nominate to the Sub-Committee for duty while engaged within its jurisdiction a local member, selected from the Department or Branch of the Public Service which is being passed under review, whose duty it will be to bring his local knowledge and professional experience to the assistance of the Committee in obtaining accurate and complete information on the special subject with which it is dealing, and in testing the evidence of witnesses on technical points.

"The Sub-Committee thus constituted will exercise all the powers vested in the Public Service Commission by the Resolution cited in the preamble and by the orders passed in connexion with it; and the Secretary of the Public Service Commission will also, so far as may be necessary and so far as his current duties under the Commission permits, act as Secretary of the Sub-Committee.

"It will be the duty of the Sub-Committee to obtain and digest evidence on definite questions of fact to be placed before the Public Service Commission when it re-assembles later in the year. The subjects of the Sub-Committee's enquiry are, first, the present regulations of the various Departments as to admission to the various grades and ranks in each; the conditions of service in each Department, and the capacity for rendering efficient service therein, of the various classes who put forward claims to such employment. The professional or departmental member should bring clearly and accurately before the Committee by means of evidence the existing organization of the Department, its technical requirements, the professional attainments essential for efficient service in its various branches, and the results of local experience as to the comparative value of the services rendered by persons of various classes now employed in the Department. It will be convenient that the Sub-Committee should closely restrict the scope of its enquiry to the practical issues which it is desired to elucidate.

"His Excellency in Council desires that every class of Her Majesty's subjects in India shall have full opportunity to explain and illustrate its claims through representative witnesses on all the subjects of enquiry."

We may trust that Local Governments will select such Forest officers to give evidence in the different provinces whose experience in the service, and professional knowledge may ensure the benefits the Department has conferred on India being set forth in the clearest manner. Every Forest officer who has visited America, speaks in the gloomiest manner of the destruction of the physical configuration and fertility of the country, which has resulted from a thorough neglect of forest protection, in that country, and we are assured that, unless our Department in India retains a nucleus of highly trained officers, whose position and education enable them to treat with District officers

on equal social terms, the efficient protection of Indian forests will not be maintained.

RHYMING REPORT OF THE FOREST CONFERENCE.

You have, I think, gone beyond your rights as an Editor in altering the rhyming lines I sent you on the late Conference, without in any way giving your readers a hint that you had done so. I must disown lines 15 to 20 from the beginning. You will excuse my criticising your lines, as you have ruthlessly cut mine out altogether, and changed the sense of what I wrote. Mine gave what the Conference arrived at, *viz.*, that we changed your curriculum greatly, and laid down one that made you work more out-door than in. Your lines give no conclusion at all, and limp badly. Again, your last two lines on the section on light grazing, with which you replaced mine, do not state the conclusion the Conference arrived at, but one of your own, apparently. For six lines of mine on using the "Forester" for advertising, you have substituted two limping lines, and lines that are scarcely grammatical. In other places, you have made other changes, and in one, interpolated four lines for which I am in no way responsible. I must ask you to print this protest as I write it, for while I am prepared to stand by what I write, and to be criticised for what I put forward, you must surely allow that wholesale changes without his concurrence or knowledge, and without a hint that you have made them, are unfair to a writer, and scarcely come within what is meant by editing.

BERAR,
9th March, 1887.

G. J. v S.

NOTE.—We must apologize to "G. J. v S." for taking liberties with his verses, but the alterations complained of were dictated with the view of giving what we considered a correct account of the proceedings of the Conference, as the official report of it is not yet forthcoming; we can only regret the lameness of our Pegasus, which may be partly due to want of exercise, the stern duties of a Forester seldom allowing time for versification.

"G. J. v S." is wrong in thinking that one result of the Conference was that the school work has become "more out-door than in," for the only changes really made in the curriculum are the introduction of theoretical Forestry into the work of the first four months, July to November, and the curtailing of the Physical Sciences course, now restricted to the first year.

Practical instruction in the forests remains just as it was in 1885-86, *viz.*, the students will, as before, be in camp in the forests from November to June, in the first year, and from November to March, in the second year, the only changes being that, a fortnight's holiday is allowed at Christmas, and the school will close during the month of June, while, formerly, practical forest work went on uninterruptedly throughout the year. It would be really more correct to say that a result of the Conference is to increase the time allotted to theoretical Forestry, and to curtail by six weeks the period of practical instruction, though doubtless, the quality of the latter will constantly improve with enlarged experience, but this will be due to the efforts of the School Staff, which have always had this end in view, and not to any suggestions of the Conference; the importance of practical forest work having always been fully recognized at Dehra.—[ED.]

INDENTS FOR TIMBER BY THE PUBLIC WORKS DEPARTMENT.

"THE Government of India having had under consideration the desirability of the more extensive supply of timber by the Forest Department to State Railways, is pleased to empower Managers of open lines of State Railways to call for, and accept, tenders from the Forest Department, for the supply of wooden sleepers for two or three years in advance, subject to the restrictions that such advance orders should be confined to the quantities estimated to be necessary for normal or ordinary renewal requirements, and be only given in cases where there is no room for uncertainty as to the nature of the sleeper which will be required for such purposes."

We have permission to publish the above Resolution of the Government of India in the Public Works Department. The powers conceded in this Resolution to Managers of State Railways cannot but prove welcome to Conservators of Forests, giving promise, as they do, of a new era in the transactions between the two Departments, and of a termination to all that inconvenience, occasionally accompanied by pecuniary loss, to which both contracting parties had been hitherto subject, by reason of no timely notice being forthcoming, which could enable the Forest Department to meet, in the spirit and in the letter, the demands of what ought to be its most important customer.

When it is borne in mind that the Public Works Department has, on divers occasions, through the inability of Forest officers to accept its sudden tenders, been reduced to obtain timber from unnecessarily great distances, or from private dealers at unnecessarily high rates, or has seen itself forced to reject the green timber prepared for it by the Forest Department in favour of more seasoned material in the hands of merchants—by which course Government has, in some instances, lost heavily through the Forest Department not having been able to dispose of the stock thus rejected—it is evident that the present Resolution should have most important results, that it should conduce to a more economical management of the State Railways, as also to a more certain, more systematic, and more intense working of the State forests.

FOREST PESTS.

I SUPPOSE that Forest officers would consider the greatest forest pest to be the person who sets fire to a forest, to be revenged on some one who has thwarted him in some way or other; but for a visitor to forests as I was last month, a small tick (*acarus*) may fairly be classed as a great forest pest.

In the forests of the Dún and Bijnor Districts, I have never met with this insect, but as you go further south-east it gradually gets worse, till it seems to culminate in the Gorakhpur District. There you cannot walk in the forest without getting numbers on you. You cannot feel it crawling on your skin, and it gets its forceps deep into your flesh before you are aware of its presence, and when removed it tears away skin and flesh, and you feel the pain for weeks afterwards. I heard of two circumstances that will illustrate what has been said and show what this little pest can do. One of the Forest guards shot a chítal one day, and as he could not get any one to help him to carry it, he carried it himself on his shoulders. The ticks left the dead animal when it got cold, and attached themselves to the man, he had them picked off, but there were so many of them, and the sores got so bad, that he was laid up for a month. In the late sleeper operations in this district it was intended at first to saw up the trees in the place where they were felled, so as to save expense, but after the sawyers had been at work three days they found that they could not lift their arms, the pain was so great from the removal of the vast numbers of ticks that had stuck to them; there was nothing for it, but to cart out the trees to depôts in the open. The fellers of the trees were used to the forests, and did not allow the ticks to get established on them, but the sawyers, drawn from all parts, and working longer in one place, could not take such care of themselves, and so the ticks upset the working plan, and greatly increased the expenditure.

A. C.

SOWING AND PLANTING BAMBOOS.

I WAS shown the other day in the Rámgarh Division of the Gorakhpur forests some clumps of bamboos raised from seed that seemed to me, to have done extra well, and as I have not seen the system of sowing and planting adopted with these described, it may be useful to some to know it. Earthern garrahs are cheap in the Gorakhpur district. 100 can be purchased for a rupee, these are taken, and five small holes for drainage purposes are made in the bottom, they are then filled with good soil and from 8 to 10 seeds sown in them, this is done at the beginning of spring. The garrahs are then placed in the ground close together, and earth filled in around them, they should be near a well for convenience of watering which is done regularly. When the rains commence, the garrahs containing the seedlings are taken in banghies to the place where they are to be planted; holes 3 feet diameter and 3 feet deep having previously been dug, and filled with a mixture of earth and leaf mould, the

garrah is placed on this earth with the top well above the surface of the ground; the garrah is then broken and removed, and the earth pressed round the mass of fibrous roots that the ball of earth contains; no more attention is given to them, and by the end of the rains the shoots are well up. Measurements were not taken, but when removed for planting they were some 2 feet high, and at end of the rains double this height. Now when they are five years old from seed they are fully established, and have culms 50 to 60 feet high, looking almost as well as clumps that were planted 13 years ago. The kind of bamboo planted is called by the natives Katbans (*Dendrocalamus strictus?*)

A. C.

GERMINATION OF BABUL SEEDS.

READING "G. J. v S.'s" remarks on this subject in the February number of the "Indian Forester," it occurred to me that the following details of an experiment carried out in this District might be of interest, and tend to throw a little light on the subject, though the results are far from conclusive.

Orders were given in February 1886, to allow goats to graze and obtain babul pods and seeds for a limited time in a reserve where babul was plentiful, and to fold them at night in another part of the reserve, where the ground was absolutely bare of any vegetation.

The experiment was commenced by my predecessor just before giving over charge to me, and the spot chosen being in a remote part of the district, and difficult of access, I was unable to observe the progress of the experiment personally. At the present time, however, there is in the place where the animals were folded a fair crop of young seedlings, averaging some three to four inches in height. The Range Forest officer of the Taluka reports, as the results of his observations, that most of these seedlings have sprung from seeds fallen or ejected from the animals' mouths, but that undoubtedly some of them have come from seeds that have passed through the stomach of the animals and been voided in their droppings.

This of course proves but little, *viz.*, only that some seeds are voided and germinate, but by further experiments and personal observation and precautions, I shall attempt this year to obtain more precise information as to the greater adaptability or otherwise for germination of seed that has had such treatment.

SHOLAPUR, DECCAN,
20th February, 1887.

G. P. M.

A REAL WEEPING TREE.

On my way to and from the Mussoorie Library I have noticed for some days a small pool of water in the middle of the road just above "Auchnagie."

It struck me as being something singular; and to-day when passing I noticed several drops of water fall into it; on looking up I saw that it was the sap from a branch high upon a tree that was falling into it; the drops were large and were falling at the rate of one a second. I afterwards noticed several other trees of the same kind on the roadside dropping sap from their branches in the same way. The tree is a large one, called by the natives Kágashi (*Cornus macrophylla?*) In the spring if the bark of this tree is wounded by an axe, the sap runs out of the wound in a great stream; some of it solidifies into a thick mucilage of a bright orange colour; it was from a broken branch that the sap was coming, broken most likely by the heavy fall of snow we had at the end of January. These trees are just bursting into leaf, but they have been weeping for the last ten days at least.

A. C.

THE INDIAN FOREST SERVICE.

Referring to the list of Rangers given on page 107 of the March Number, a correspondent has kindly informed us that in Bombay and Sindh the number of sanctioned Sub-Assistants and Rangers is as follows:—

Salary in Rupees.					Total.
200 to 150	100	70 to 80	60	50	
13	5	8	8	15	49

We do not include men on less pay than Rs. 50, though Range officers in Bombay draw salaries down to Rs. 20 per mensem. This brings up the total number of Sub-Assistants in India to 62, and of Rangers to 200. Many of the Sub-Assistants are in charge of divisions, and the number of Rangers is very far from Sir D. Brandis' estimate of 1,000 or 1,500, though we have little doubt that if each member of the executive staff were entrusted with an area of forest which he could really manage efficiently, that the above numbers would not be found excessive. If one of our friends in each circle or province

could kindly inform us what are the number of ranges into which the forest could be fairly divided, and the area of each, and under men of what grade they are at present, it would be highly instructive.

CLEARING FIRE-LINES OF FOREST GROWTH.

I SHOULD be glad to hear what other officers say to the following proposal—not, I believe, by any means a new one, yet not as yet carried out on a large scale anywhere that I know of. In burning the fire-lines of plains' Divisions, would it not be advisable to remove all the timber from the middle part, leaving, however, a fringe of tree-shade along each edge? By doing this, the grass on the exposed part would dry before the grass in the forest, and would also burn much more clearly, and the danger of a furious blaze, when burning the line, would be obviated by the presence of the fringe of shade (and consequently of somewhat greener grass) along the edges. Since the trees on the line are annually to undergo scorching, we cannot expect them to come to much good, and may as well sell them. I suspect too, that the lines could be burned more quickly, in addition to the important consideration that they could be burned earlier. Of course this plan should only be adopted where there was no doubt that the position of the line would never be changed. If there is anything to urge against this plan, I should be glad to hear it.

Q.

THE SALE OF OIL IN SWEDEN.—A new branch of trade has sprung up in Sweden, and promises to become very important. Oil for illuminating purposes is extracted by dry distillation from the stumps and roots of trees remaining after a wood has been cut down. Other products are also obtained, such as turpentine, creosote, acetic acid, and tar. This oil, however, cannot be burned in ordinary lamps, as it contains too much carbon, and throws off too much smoke. Mixed with benzine, it can be burned in ordinary benzine lamps. Factories have already been started, and there should be a considerable field here for the carrying on of this new kind of industry.—*Timber Trades Journal.*

II. Official Paper.

COOPER'S HILL COLLEGE.

No. 287, dated 4th December, 1886.

From—Sir A. Taylor, K.C.B., *President of the Royal Indian Engineering College, Cooper's Hill.*

To—*The Under-Secretary of State for India.*

The reasons given in Mr. Godley's letter No. 1561 R. S. and C. of the 3rd September last, why Lord Cross did not think it desirable to sanction my recommendation that a special teacher of Entomology be employed for the benefit of the Forest Students studying here, were two—*viz.*, the cost of the proposal with special reference to the present state of the finances of Indai, and the risk of overwork involved in the multiplication of subjects.

It appears to be accepted that it is not right that a Forest officer who may by-and-by be an adviser of the Government of India in forest matters should be wholly ignorant of the habits and ways of insects which injure the valuable property in his charge, and should not know even how to make suitable investigations when he sees injury being done, to ascertain what insect is causing it, what its habits are, and what remedy may be applied.

In asking His Lordship's consideration of the following observations, I shall take first the second objection referred to above, and shall limit myself to the case of the five Forest Students who entered in September 1885, for the reason that the ten who entered this year have not yet had time to establish a distinct character.

Confining myself then to the five Forest Students of 1885, I beg to state that one is Captain of our boats, another is Secretary of our Cricket Club, that three are in our first foot-ball team, and that last summer the five challenged the rest of the College, numbering more than 100, to a four-oar boat race, which they won against the best crew the College could put afloat.

I do not know that they could be expected to do more if their object was to demonstrate their physical vigor and energy, and Lord Cross will probably consider that these facts dispose fully and finally of the doubt raised in respect of overwork; but I may add that there is nothing whatever in the appearance or

habits of these gentlemen to lead to the supposition that they are burdened with work, or have not sufficient time for recreation.

According to the schedule of studies now in force, they have about the same amount of work as the Engineer Students during the first year, and less than the Engineer Students in their second year; their Saturday mornings (from 8-30 to 12-15) in this year remaining available for Entomology.

While recognizing on the one hand, that they came here to make the most of their time, on the other hand there is no one more alive than I am to the importance of training young men in active and robust habits.

I now turn to the financial objection, and possibly it might be difficult to deal with if the amount asked for were not so small and the importance of the subject so great. The outlay to which sanction is asked is about £100 per annum (or £10 for each of the ten students who will leave the College yearly), for giving them elementary instruction in a subject which bears strongly on the work of their lives, and the importance of which to men in the position they will occupy is not, as far as I know, questioned by any one. I submit that the importance of the subject is out of all comparison to this trifling outlay.

I would also ask consideration of the fact that the cost to the Government of India of the Forest Students studying here is a good deal less than the amount they pay in fees. The figures are approximately as follows:—

Addition to the Current Expenditure of the College caused by the Forest Students.

	£	£	£
		62 × 20 =	1,240
Instruction.	£		
Professor of Forestry, say, ...	700		
„ „ Botany, ...	450		
Laboratory and Museum expenses, say, ...	100		
Tours, say, ...	400		
			1,650
Total annual cost, ...			2,890
Against an income of—			
Fees of 20 Students at £180 each, ...			3,600
Leaving an annual saving of, ...			710

And there is the further fact that a very considerable saving has resulted from the transfer of the students for the Forest Department from France to this College, a saving which I estimate at £258 for each Assistant Conservator, who joins the service—that is, £2,580 annually for the ten students who will in future pass out of the College each year.

These two sums amount to a total annual saving of £3,290.

But I venture to press my recommendation not on the ground that this large saving might justify the small expenditure to which I ask sanction, but on the ground that the instruction I desire to see given is of a character that should be given to every Assistant Conservator before he enters the service of Government. It has been given to every member of the Department who has been taught at Nancy, and it can be given here now at quite a trifling cost.

It may be thought that the object I have in view may be obtained in a less expensive way; in fact, that the desired instruction might be given by one or other of the two existing Professors. To this proposal the answer is that however feasible it may be some years hence, when the instruction in Forestry and Botany has after several careful revisions assumed a fairly permanent shape, it is quite impracticable at present. The hands of each of the Professors is full to overflowing in preparing and delivering his course of lectures, and in maturing the details of instruction to be given during the present session.

The explanations I have now offered may perhaps lead Lord Cross to authorise me to secure the services of an instructor in Entomology, so that this subject may form a permanent part of the instruction given here, and this is what I recommend. But if Lord Cross is not satisfied that a full case has been made out, then I would ask him to sanction the employment of a special instructor in this subject for the limited period of two years, from 22nd January, 1887 to 22nd January, 1889, the teacher to give 30 lectures and attendances in each year, as explained in the annexure to my letter of the 20th July last, receiving a fee of £3 10*s.* for each attendance in full payment of all expenses. The total expenditure to be incurred in the two years would amount to £210 only. This arrangement would meet the difficulties that weigh onus at the present moment, and would bring up the question of the arrangements under which Entomology should be taught for reconsideration two years hence, when we may hope that the pressure on the Professors of Forestry and Botany will be less than it is now.

No. 2335, dated 4th January, 1887.

From—J. A. GODLEY, Esq., C.B., *Her Majesty's Under-Secretary of State for India.*

To—SIR A. TAYLOR, K.C.B., *President of the Royal Indian Engineering College, Cooper's Hill.*

I am directed by the Secretary of State for India in Council to acknowledge the receipt of your letter of the 4th December, 1886, and in reply to inform you that, in consideration of the further representation which you have made as to the advisabi-

lity of affording the Forest students at the Royal Indian Engineering College, Cooper's Hill, instruction in Entomology, similar to that deemed an essential part of the course at Nancy, Viscount Cross is prepared to sanction, for a period of two years from 22nd January, 1887, the arrangements detailed in the 12th paragraph of your letter under reply. At the expiration of the period in question, the matter will be open to revision.

NETTLE TREE.—In reply to "R. P. (Birmingham)," the *Celtis Australis*, or nettle tree, is grown on the Mediterranean. It is an extremely compact wood, hard and dense, and will take a high polish. Cut across the grain and polished, it resembles satinwood. In Southern Europe it is used for furniture, flutes, carvings, whip handles, &c. The American *nettle tree*, called also beaverwood and hoop ash, is a different species, and rare. We believe it has similar qualities, but do not remember having seen a sample. Perhaps some of our readers can give you some further information. The *hack berry*, another American *Celtis*, is one of the finest forest trees on the banks of the Ohio, and yields, according to Michaux, a fine-grained and compact wood, perfectly white when first cut, and apparently possessed of valuable ornamental qualities.—*Timber Trades Journal.*

THE people of Tinnevelly have been airing a grievance in the Madras papers, regarding certain restrictions said to have been placed upon the pasturage of cattle in that district by the forest regulations. Colonel Walker, Conservator of Forests, has taken upon himself to show that there is no ground for the charges brought against the Forest Department in this matter. That instead of any fresh restrictions having been placed on cattle-grazing in the Tinnevelly forests since the passing of the Forest Act, much greater liberty has been allowed free of charge, the only condition imposed being that no fires should be lighted. But within three months from the date of the concession the forest had suffered from fires to the extent of many thousands of rupees. Still the concession has not been withdrawn, as the Madras Government is most anxious to do all it can to promote the welfare of the ryots in the neighbourhood of forests.—*Indian Agriculturist.*

III. Notes, Queries and Extracts.

TABASHEER.—I have often wondered that this curious substance has never attracted more attention. But scanty references to it are to be found in books, and yet it seems to me that few more singular things are to be met with in the vegetable kingdom.

In Watts's "Dictionary of Chemistry," (Vol. V., p. 653), exactly six lines are devoted to it. It is defined to be: "Hydrated silica, occurring in stony concretions in the joints of the bamboo. It resembles hydrophane, and when thrown upon water does not sink till completely saturated therewith." It is further stated to be the least refractive of all known solids, and an analysis by Rost von Tonningen of a specimen from Java gives a composition of 86·39 per cent. silica soluble in potash, 4·81 potash, 7·63 water, with traces of ferric oxide (to which I suppose its occasional yellowish colour to be due), lime, and organic matter.

There are several specimens in the Kew Museums, partly derived from the India Museum. All consist of small irregular angular fragments, varying from the size of a pea downwards, and opaque white in colour. It is obvious that these fragments are the débris of large masses.

Now, the presence of considerable solid masses of so inert a substance as hydrated silica in the plant-body is a striking fact. At first sight, one might compare it to the masses of calcium phosphate which form the endo-skeleton in the higher animals. These, however, serve an obvious mechanical purpose, which cannot be attributed to the lumps of tabasheer in the hollow joints of a bamboo. The presence of silica may sometimes serve an adaptive purpose, as in the beautiful enamelled surface of canes. And according to Dr. Vines ("Physiology of Plants," p. 21), "Struve found that it constitutes 99 per cent. of the dry epidermis of *Calamus Rotang*."*

In a few other groups of plants, such as *Equisetum* and the *Diatomaceæ*, it is a characteristic constituent. In all cases it principally occurs in the cell-wall (Vines, *l.c.*, p. 137). This has suggested the highly ingenious speculation that, seeing the intimate chemical relationship which obtains between silicon and

* Sachs remarks ("Text-book," second edition, p. 700) that silica accumulates chiefly in the tissues exposed to evaporation, though this clearly does not apply to the case of diatoms.

carbon, there might be a silicon-cellulose. I notice that Count Castracane, in his Report on the *Diatomaceæ* collected by the *Challenger*, speaks of its "having been already shown that silica is sometimes substituted for carbon in the formation of cellulose" (p. 7). Judging from ash-analyses it might be supposed that silica was an essential constituent of gramineous plants. But by the method of water-culture Sachs has found that maize, for example, will grow with only a trace of silica. I must confess to ignorance of all that may have been done in the matter recently. But Ladenburg thought, and I think with reason, that the indifference of the plant to silica was a strong argument for a silicon-cellulose in which silicon might or might not with equal physiological convenience play the part of one or more atoms of carbon. Fascinating as this hypothesis is, I am bound to say that the prolonged investigation which he devoted to the question is on the whole adverse to the idea of silicon playing any part of the kind.

It still remains then an unsolved problem why, when no adaptive end is involved, plants should take up such relatively enormous quantities of silica. The case of the frustules of *Diatomaceæ* is peculiar, as there the silicious wall is apparently a continuous plate of inorganic matter capable of resisting, without impairment, treatment by the most destructive and disintegrating agencies known. Yet Castracane adduces evidence to show that such walls can grow; and as this can only be by interstitial growth, a molecular constitution is implied quite different from anything physical, and precisely similar to that of a cellulose membrane. He quotes, indeed, von Mohl for the opinion that the wall is not simply inorganic, "but only an organic membrane which is impregnated with silex."

Now, in the case of tabasheer, it is quite evident that the plant takes up an amount of silica beyond its powers to use, and so it is exuded into the hollow cavities of the bamboo stem. I do not mind confessing that, in so far as I had reflected on the matter at all, I had pictured to myself this as taking place by some process of secretion, so that the mass of tabasheer ultimately accumulated from successive portions of thrown-off silica. I was obliged, however, to give a little more serious thought to the matter when Prof. Cohn, of Breslau, wrote to me that he proposed to investigate the whole subject, and asked for help in the way of specimens and information. It then struck me what a very singular thing the phenomenon of the occurrence of tabasheer really was. I set to work to hunt up in the literature of Indian botany some rational account of the matter. The only ray of light I got was from the "Forest Flora of North-West and Central India," by Dr. Brandis, late Inspector-General of Forests to the Government of India. Everyone who knows Dr. Brandis knows that he gave to administration the energy he would more willing have devoted to

scientific pursuits. I was not at all surprised to find, therefore, modestly hidden in his book (p. 566) the key to the riddle. He says: It is not at all impossible that the well known silicious deposit *(tabasheer)* which is found in the joints of this and other species [*Bambusa arundinacea*] may be the residuum of the fluid which often fills the joints." I communicated this to Prof. Cohn, and he was good enough to tell me that he quite agreed that this was the correct explanation. I at the same time wrote to Dr. King, the distinguished Superintendent of the Royal Botanic Garden, Calcutta, to know if it were possible to procure specimens of tabasheer *in situ*, as we possessed in our Museum nothing but broken fragments. I extract from several letters he has written me the following particulars:—"January 11. I have inquired of several old workers as to the situation tabasheer occupies. They all say it is found either on the *floor* of the joint, or if (as is so often the case in *B. Tulda*) the stem leans over, it is also found on the lower wall. It is never found on the roof of a joint. . . . . Tabasheer is not common in bamboo grown near Calcutta. And, besides, it is apt to be forced out of its natural position by the force used in breaking a joint open. There is no external mark by which a tabasheer-bearing joint can be recognised prior to being opened." "January 18. I have got a specimen of tabasheer *in situ* for you. It concretes *as a jelly*, and is now being carefully dried off."

I think that these extracts (in which the italics are mine) fully confirm the explanation as far as I know first put out by Dr. Brandis. The rapidity of growth of a bamboo shoot is well known to be enormous. The root-pressure is probably equally great. The joints, at first solid, become hollow by the rending apart of the internal tissues, and water containing silica in solution is poured out into the cavities so formed. When the foliage is developed, transpiration is active: the water taken up from the ground is rapidly got rid of; not merely is the root-pressure compensated, but the water poured out into the joints is re-absorbed. It is not easy to see why the silica should not be always taken with it, as in the vast majority of cases it no doubt is. But in the cases in which it is left behind it has apparently simply undergone a process of dialysis. The determining causes of the occasional deposit of tabasheer are, I think, still obscure. But, as Prof. Cohn intends to investigate the subject, I think we may pretty confidently look forward to an exhaustive explanation.

It is a well-known fact that a large proportion of the ash-constituents of plants may have but little significance in their nutrition. The chemical constitution of plants, as far as their ash is concerned, to a large extent varies with the nature of the soil in which they are grown. It is quite certain that they will in consequence take up a vastly larger proportion of certain constituents than they can turn to any physiological account. Ta-

basheer is a striking instance of one such case. The calcareous massses found in the wood of many Indian trees mentioned in "Nature," Vol. XXI., p. 376, affords another.—W. T. THISELTON DYER.—*Nature.*

DESTRUCTION OF GAME IN GOVERNMENT RESERVES DURING THE RAINS.—With reference to the letters signed "H. L." and "H. H. L." on game preservation and closed forests, which appeared in the "Asian" some time since, and your article on the same subject in your issue of the 28th December. I shall feel obliged if you will kindly afford me space to make known to the sporting public some startling facts regarding the unlawful destruction of game in the Government closed forests which have lately come under my notice. The greatest destruction, I might even say slaughter, on an extensive scale, takes place in the Sewaliks and adjoining forests during the rains, that is between the months of July and September, when, owing to the absence of danger to the forests from fire, and the unhealthiness of the season, the presence of the usual forest guards is considered unnecessary at one or two stations, but unfortunately as regards game very important ones, so that there is no one left at these chokis to enforce, or at least to a certain extent regulate, the new game laws so clearly stated in the recent forest circular on this subject, and in which, besides the prohibition with regard to shooting does, young stags, &c., it is distinctly specified that no sambhar (maha or jerao) are to be shot between the 30th of April and the 1st of October.

I shall endeavour to show you in this letter how far these rules are observed by irresponsible native shikaries. I have lately come across rough chapars or shanties, large enough to accommodate six or seven persons on the banks of raos or dry water-courses in the Sewaliks, and on enquiry was told that they were erected and used by the local shikaries in the rains; and round about these temporary abodes, pegs for stretching skins, charred bones and other outward and visible signs of a hunter's abode were apparent. Many of the villages adjoining the Sewaliks are inhabited by Gurkhas and others, several of whom have either guns of their own or have no difficulty in borrowing them from the zemindars. These men tell you openly that the best sport in the Sewaliks is to be had in the rains, when, owing to the myriads of various kinds of flies and other vermin incidental to that season, the animals are driven down to the dry and comparatively open water-courses, and may be seen in considerable numbers standing about here and there, driving away their tormentors. It is during this season, when the climate is baneful, [illegible] to the jungly and acclimatised villagers, that the game is killed to an extent that would make persons unac-

quainted with these facts gasp and stare. Shooting with these men at this season is a trade and a profession, and as long as they can get the skins and meat they consider it unnecessary to trouble themselves about the sex or age of their victims.

It is not uncommonly asked how it is that, notwithstanding the most stringent forest rules, the game does not appear to increase even in the Sewaliks; but any one taking the trouble to enquire will not have far to seek for an answer. It is simply this, that the does and fawns are spared by sportsmen during the months that the forests are open, only to be slaughtered by irresponsible poachers later on, and in the rainy season.

As an instance also how mercilessly the game here is hunted by others besides *bonâ fide* sportsmen, I might mention that on one occasion last season I met a gang of seven or eight of these unlicensed shikaries camped on the borders of the closed forest, which they daily visited; and I subsequently heard that they had made an excellent bag of does. Now it was clearly the duty of the forest guard in charge of the choki to report these men, but during my stay in that neighbourhood they were allowed to remain unmolested. This is a serious evil, and well worthy the attention of forest officers and others interested in the preservation of game. No doubt the root of the evil lies in the careless and promiscuous way licenses are granted to villagers, ostensibly for the protection of their fields. The guns thus allowed them are lent to and used by persons of their own community, who for the time being convert themselves into game butchers and skin dealers, and prowl about the closed forests at the season already referred to. Besides, for every licensed gun in a village, there are half a dozen for the possession of which their owners have no authority. Your suggestion that, "for the protection of crops, a gun with a barrel only a few inches long would be quite efficacious" is excellent, and should be borne in mind by the civil authorities when issuing licenses to the zemindars. Even if nothing were said as to the efficiency or otherwise of his licensed gun, the zemindar should be distinctly made to understand that, if found in his possession or in the hands of a shikari outside his fields, or anywhere within the forest limits, he would be rendering himself liable to a heavy fine, imprisonment, or in fact any punishment suited to the gravity of the offence. The patrols, guards and all other forest subordinates should be made thoroughly acquainted with these rules, and in some measure held responsible for their efficient working. Until this is done I don't see how game is to be successfully preserved. "The closing of large areas of forest land, during certain seasons, affects sportsmen at present." No doubt it does, but for their benefit and advantage. Still game is getting thinned out, even in these comparative preserves, and there is no knowing how scarce it would become if the forests were open throughout the year. Any argument based on the abundance of game in form-

er years, when none of the forests were closed to the public, is untenable now, since in those days sportsmen were not so numerous and there was also more jungle. With due deference also to the opinion of your correspondent "H. L." embodied in your remark "that the system of closing the forests must in a short time lead to an excessive increase of dangerous and destructive animals" is somewhat fanciful, for our friend, the poacher, and others of his class, are sworn enemies to stripes and his kindred, and spare no pains to add them also to their bags whenever they visit the forests. As to wild elephants the periodical kheddar are sufficient to keep them down.

Rules and regulations regarding fishing are quite as carelessly enforced, though on paper and printed circulars they appear formidable enough. There is not a village perhaps in the Dún in which there are not several nets with meshes far smaller than the prescribed 1½-inch mesh. These are used at nights and openly during the rainy season, when, I might say, maunds of fish are caught, dried and sold. But, as in the case of shooting, extra supervision and more stringent instructions to the forest guards and patrols are necessary, if it is desired that the game laws should be something more than a dead letter and a matter of form.—GAME-KEEPER.

DEHRA, *31st January, 1887.* —*Asian.*

HYBRID POTATOS.—The following notice on this subject appeared in the "Times" in November last:—

"It is known that the species of potatos, *Solanum tuberosum*, from which all the varieties in cultivation sprung, is a native of the higher Andes mountains, where rain is almost unknown, and the varieties we possess may therefore be liable to degeneration in stamina in our moist climate. But there exist other varieties of potato which had never been cultivated before recent experiments were made. One of them is the *Solanum maglia*, discovered by Darwin in the Chonos Archipelago, 44 degrees to 46 degrees south latitude; and this plant is remarkable as choosing for its habitat low-lying marshy places near the coast. Could the *Solanum maglia* be made the parent of a sort of potato which would not be averse to humidity, and would not become affected by the *Peronospera infetans*, or potato disease?

"At the instigation of Earl Cathcart, who procured from Mr. Baker of Kew, tubers believed to be of the new variety, Mr. Arthur W. Sutton of Reading, commenced in 1884 the important and hopeful experiments which have now reached a mature stage. The so-called *Solanum maglia* bore abundant flowers, but had never been known to yield a seed-berry. The red-skinned tubers were started in pots, and care was taken to fertilize the flowers with pollen from some of the best so-called disease-

resisting potatos at present in cultivation. Three fully developed berries, well-filled with seed, were obtained, and these were sown to produce seedlings in 1885. The effect of cultivation upon the *Solanum maglia* was, that while the tubers received from Lord Cathcart were about the size of a pigeon's egg, the produce of the first year's growth consisted of tubers quite as large as an ordinary potato, with as many as eight up to twelve tubers to a root. Cooked they proved of fair quality for the table. There now remains to follow the fortunes of the seedlings to the present time.

On Monday a number of scientific gentlemen, including Dr. Hogg, Dr. Masters, Mr. Shirley Hibberd, and other authorities in potato history, visited Messrs. Sutton and Sons' trial grounds at Reading to notice the experiments, which have been very successful and satisfactory. It is agreed that the parent in the cross was not, after all, a true specimen of *Solanum maglia*, but was a specimen of a wild form of *Solanum tuberosum* of a distinctly different geographical origin from the variety which furnished the varieties commonly cultivated, and this wild form has been preserved for many years at Kew gardens in a bed side by side with the plants of *Solanum maglia*. Twenty-three plants were obtained from the seed grains in 1885, and the tubers set again in the present year vastly increased in weight, up to 122 lbs. from 13½ oz. The cross is between the wild *Solanum tuberosum* and the variety known as Sutton's Reading Russet. In point of quality and shapely form, they leave nothing to be desired, and reach a high standard of merit. Several other crosses have been obtained in this first attempt to introduce new blood into the potato, successful hybrids being bred from the wild species crossed with Walker's Regent, Paterson's Victoria, and other popular varieties."

Mr. A. H. Blechynden writes to the Society from London on the subject as follows :—

"The subject of potato hybridisation has been recently engaging the attention of horticulturists in this country as a reference to the accompanying* printed papers will show. Under the impression that it may be considered desirable to make an experiment in the economic portion of the Society's garden, I have been in communication with Mr. Arthur Sutton, of Sutton and Sons of Reading, and the authorities at Kew. I now enclose a letter from Mr. Sutton on the subject, and forward a few tubers of *Solanum maglia* just received from Kew. It is probable as *S. maglia* prefers low-lying marshy places, that a cross between it and *S. tuberosum* (should you succeed in effecting it) could be successfully introduced in similar localities in India, where the

* A copy of the "Times" of 29th November, 1884.
The "Journal of Horticulture" for 18th November, 1886, and scraps from the "Times" and "Daily Telegraph" of November 1886.

ordinary potato cannot be advantageously cultivated. Under any circumstances it is worth a trial.

"Should it be deemed desirable I will accept Mr. Sutton's kind offer of a supply of the wild form of *S. tuberosum.*"

The following is the letter from Mr. Sutton referred to :—

"In reply to your letter of the 22nd instant, I regret that our stock of the true *Solanum maglia* is exceedingly limited, although we have a very large quantity of a wild form of *S. tuberosum* which has been cultivated for some 30 years past in the Royal Gardens at Kew.

"I shall be very glad indeed to ask your acceptance of some of the latter, and if you would also like some of the *S. maglia* I am sure Mr. Baker, the Curator of the Royal Herbarium at Kew, would be most happy to supply you.

"As you may have gathered from some of the reports appearing in the press, it is now ascertained that the tubers we have been experimenting on under the name of *S. maglia* were really the wild form of *S. tuberosum* above referred to, which had been sent to Lord Cathcart by mistake. Awaiting your reply.

"*P.S.*—I send you by this post a copy of the "Times" for November 29th, 1884, and the "Journal of Horticulture" for last week, which contain some interesting matter in connection with our potato experiments."

The *S. maglia* tubers have been duly received. As this is an unsuitable time for planting them in Bengal, the Society propose to send them to Darjeeling to be grown, and the increased stock can be planted here in October or November.—*Proc. of Agri-Horticultural Society of Madras, January 1887.*

THE PRESERVATION OF FISH IN THE PUNJAB.—With reference to the letter of Mr. H. S. Dunsford, in your issue of the 20th instant, regarding the preservation of fish in the Punjab, I should, as Honorary Secretary of the North Punjab Fishing Club, like to say a few words. As stated in the above letter, the Punjab Government are averse to forwarding for the information and consideration of Government, the letter written by General H. C. Wilkinson, C.B., late President of this Club recommending that a Fishing Act should be enforced, and submitting certain propositions which he considered necessary to be enforced, in order to check the enormous destruction of small fish; which goes on by every possible variety of methods in almost all the small tributary streams of the Punjab. They, however, referred to a letter received from Government in reply to a letter of Sir Robert Egerton's, the later Lieutenant-Governor of the Punjab, submitting a draft Act and rules for the preservation of fish in the Punjab, as long ago as 1880, in which it was stated that, although the Government did not at the time consider such legislation desirable, nevertheless, if at any future

period the evil was attaining more serious proportions they would be willing to reconsider Sir Robert Egerton's opinion. The question now arises as to how evidence is to be collected showing that the evil has greatly increased, and has attained serious proportions referred to since the time when Sir Robert Egerton's draft Act was submitted. This I believe could be done if every one interested in the subject in the Punjab would compile briefly a few notes of the actual destruction of small fish that may have come to their personal notice; giving such information as they might be able to on the various descriptions and methods of destruction employed for the purpose.

If every member of the North Punjab Fishing Club, who is able to, would forward such a statement as is above referred to, a large mass of evidence would be collected and compiled, which doubtless would have great weight; and perhaps would be ultimately the means of the opinion of Sir Robert Egerton being reconsidered.

In this work the hearty co-operation of others, more especially of district officers, is solicited—even although they themselves may not be members of the Club. I would venture to say that in this manner, a formidable mass of the most reliable evidence could be collected. The evil at present is very great, and the small fish in the higher beds and small tributary streams get no chance. I believe that India is almost the only country in the world where Fishery Laws are not enforced. In China, where the fish-eating population is enormous, and a vast consumption, of fish takes place, the supply has not failed, and this is entirely due to a wise and careful legislation for the preservation of this important food supply. With reference to Mr. H. S. Dunsford's remark, that he does not consider that the chief depredators on our rivers are vagrants of no fixed residence, I would point out that this remark only referred to the streams in the vicinity of Rawalpindi, where such is actually the case; as can be proved by all land-owners on the adjoining banks. Farther down country, where the inferior Hindu population is of a different class, and far greater in number than in this part of the country, each village has its regular fishermen, and netters, as Mr. Dunsford states; but this is not the case in the Northern Punjab. In conclusion, I would briefly refer to the very spirited action of the Kashmir authorities, in prohibiting the destruction of fish in the Kashmir and Jummú territories by the use of dynamite. Also to Rajah Moti Singh of Púnch, who has promised to prohibit the use of small mesh nets in the river Púnch from Tangrot to Kotti, and in certain parts of the river Mahal. Moreover, I hear from the Púnch, that the most stringent orders on the subject have been issued. The thanks of all fishermen are due for this legislation on the Púnch, one of the finest, if not the best, fishing rivers in India.

It is to be hoped that this year will see a large increase in the

numbers of the North Punjab Fishing Club. Prospectuses and all necessary information about the Club can be obtained on application to the undersigned, by those wishing to join; and fishing diaries, maps of new fishing grounds, and other information will gladly be received and published.—G. H. LACY, *Hon. Secy. North Punjab Fishing Club.*

RAWALPINDI, *22nd January, 1887.*—*C. & M. Gazette*, reprinted from *Indian Agriculturist.*

OUR FOREST LAWS AS THEY ARE MADE APPLICABLE TO GOVERNMENT RESERVES.—I am sure most of your readers interested in the preservation of game in our forests would be most thankful to "Game-keeper" for his able article in your issue of 8th February on a subject that much deserves the attention of the authorities concerned. I am sorry to state that matters are not different down here—as regards the lawless and ruthless destruction by the hill tribe, the Malayalies, in the face of the most rigid and appropriate law as it would seem protecting a forest. This may appear very incredulous to those working in the forest, but they may not be aware that the Malayalies as a set are very acute, and are apt to set at nought the keenest arrangements the authorities may come to with the object of preventing poaching.

The Coffee Stealing Act, as far as they (the Malayalies) are concerned, we know is a dead letter. They have set the law at defiance. They never carry coffee now, but sell under an arrangement in the village, so that section 10 of the Act is not made applicable.

One *not* owning an estate, and who is in possession of coffee, has simply to make over his share to one who owns an estate, and the latter sells to the Chetty both as his own. So that virtually twenty men sell, but only ten own estates, come forward with the bulk of coffee, and the Chetty cannot help but making the entry in his pass book (under section 5) that so many maunds of coffee was purchased from the ten. Now let us see how the Malayalies get what they want in the reserves.

They have simply to come to terms with the forest guards, and there is not the slightest doubt about this, from the fact of the Malayalies adopting their usual plan of going down to the plains periodically and bagging game in a most fashionable way as if there was no law in vogue to prevent them. It is not difficult to understand that the *guards* are willing to accept a small bribe, for their pay is a miserable pittance, just enough to keep them from starving. We wanted very much an enactment passed into law for the security and preservation of game, and we were under the impression that the forest law, which it behoved our Government to introduce, served our purposes

well, as, although it does not actually profess to be a game law yet, it would have had the desired effect if worked with a good deal of scrutiny.

One would suppose it to answer very well indeed taking into consideration the many obstacles thrown in the way of procuring a license to shoot in the reserves, and the several restrictions under which it is granted, and these we thought might also be a stumbling block in the way of the Malayalies.

Now to procure a license you have to attend personally at the forest office for the purpose of your identity being taken; on getting it it becomes useful only to you, as others accompanying you with guns have to take fresh licenses. You can hunt only during a portion of the year, the rest of it being the breeding season. The license is not transferable, and you cannot net or trap. You can only hunt in the reserve defined in the license. All these obstacles, as I call them, I thought would tend to stop the Malayalies from taking any license at all.

It is customary for them to go in large numbers—in fact a whole village turns out.

In this case in the least about 30 licenses would have to be taken, as about that number of guns are carried, and their most indispensable appendages, their traps and nets, they would have to leave behind. Under the forest laws can be seen now-a-days any number of tracts taken up as "Reserves" with sometimes a sprinkling of jungle in them. Posts are placed with pots whitewashed on them near each other defining the boundaries of the reserved land, so that no mistake could be made by trespassers. A duplicate of your license is in the hands of the forest guard, so that it is impossible to escape perception, and how comes it then that the Malayalies are bagging game in the usual way? I have known it to be the case, for four villages to have turned out separately and bagged for their respective lots a couple of deer or a wild boar. The whole of the forests, to the best of my knowledge adjoining the slopes of the Shevaroys to the west, have been so taken up, with the exception of some cultivation in two villages in the plains.

The reserves in some instances have come up to the precincts of the villages up here. And yet, is it not surprising, that all these precautions on the part of Government don't deter or slacken the usual custom of the Malayalies to cause such enormous destruction of game on the Shevaroys.

It would be a good plan if the forest authorities had their guards constantly shifted from place to place to prevent any intimacy growing between them and our hill men. On the slightest suspicion a strict and searching enquiry should take place. As we have "reserves" up here, it would be well to have a few peons stationed on the spot, for then we could communicate with them directly instead of, as it is now, having to send to the head office, some fifteen miles off, the delay

giving the trespassers ample time to hide and make themselves scarce.—W. M. D.

YERCAUD, SHEVABOYS, *26th February, 1887.* —*Asian.*

SUPPLYING WALNUT TO GOVERNMENT DEPARTMENTS.—In reply to "J. C. B." (Napoli), the walnut supplied to the Government factories, for manufacturing the butt and fore-end which compose the stock of small arms, is, we believe, almost entirely Italian. The wood must be of first-class quality, combining lightness, hardness, and closeness of grain. The rough butts and fore-ends are closely examined on arrival, and, should any of the following defects be observed, they are rejected :—(1) under size ; (2) crooked, at fore-ends only ; (3) galls, result of wound in tree ; (4) shakes or cracks ; (5) rindgalls, the result of injury to bark of tree when young ; (6) discoloured wood ; (7) bines or knots ; (8) cross-grain ; (9) bad quality ; (10) fly and worm holes ; (11) impregnation with salt water. All except the last of these defects are readily detected by the examiners, and should the appearance of the wood lead them to suppose that it has been damaged by salt water, a shaving is taken off with a spokeshave, and is dipped in a solution of nitrate of silver (1 grain in 1 ounce of distilled water) when, should any salt be present in the wood, a white precipitate is found of chloride of silver. If wood which has been damaged by salt water be used for a stock, it will rust any steel or iron with which it comes in contact ; and no method is known by which the salt can be removed from the wood when once damaged. The butts and fore-ends are usually in a half-seasoned condition when received, and are stocked to season. Green wood requires about three years to season. If it is necessary to hasten the seasoning of the wood it is placed in a desiccating room, and subjected to a heat of 60 degrees, gradually increasing to 90 degrees or 100 degrees Fahr. If half dry when placed in the desiccating room they will be ready for use in about six or seven weeks.—*Timber Trades Journal.*

MR. LOWRIE writes as follows from Ajmir :—"We are having a very bad time of it owing to the short rainfall. I have had to open out all the forest blocks this year for grazing, and though I have no doubt that the forests will be put back a few years, the help that the opening out of the blocks will give the villagers in tiding over their present difficulties, will be very great."

WITH reference to my note to Colonel Campbell-Walker in the January number of the "Indian Forester," regarding the appointment of Sub-Editors to the "Indian Forester" for each province in India, I have received several offers of assistance, for which I am greatly obliged, but on fullest consideration of the matter, it appears to me that it is better for the responsibility of the Editorship to remain solely with the Editor, and therefore whilst expressing my gratitude to those gentlemen who have so kindly offered their services as Sub-Editors, I hope that they will believe that I am acting for the best in not altering the present arrangement, so far as to publish their names on the cover of the "Indian Forester," but will merely ask for their general support in forwarding information on provincial matters, and for their advice from time to time regarding the management of the "Indian Forester."

THE

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THE INDIAN FOREST SERVICE.

THE "Indian Agriculturist" still maintains that the Controlling Staff of the Forest Department should, after a few years, be entirely selected in India.

We have read evidence about Indian education brought before the Public Service Commission, and the complaint is constantly made, even by Natives, that education is superficial, and that English professors are essential for any further improvement. Can we allow our Department to be officered entirely by men of defective general education, and would it be possible in this case for us to resist the demands of cultivators for fresh rights and privileges in our forests, until all the good work of the last twenty years should be destroyed?

What has happened to the forests of Mysore, which British rule left in such magnificent condition to a Native rule? It would be highly instructive if officers who know their past and present condition would write an account of the change, for our pages.

The Forest Controlling Staff must consist of men of first-class general education, of good social position, of great personal activity, and with a first class professional training, and such men are best obtained by public competition in London, followed by a technical education at Cooper's Hill.

The Cooper's Hill appointments are open to every one in the Empire, and the officers from that College are trained at their own expense, whilst in India we cannot train a Ranger without paying for him.

To say therefore, with the "Indian Agriculturist," that Government is actuated by a wish to maintain *vested interests* when it retains the Cooper's Hill training, is an indefensible statement.

Our Government has always shown the greatest public spirit in the establishment of the Forest Department, if it wished to go in for *vested interests*, the Department might have been kept

a Patronage Department, as the Police is at present, but the best German Forest officers have been engaged to organize our Department, and our Staff has been trained in France and Germany, and now that a strong Forest School for the Empire is established at Cooper's Hill, the "Indian Agriculturist" talks of *vested interests*. English fathers do not mind spending money on their sons, and Indian fathers can do the same, if they really wish their sons to enter our department, in the higher grades. Our present Forest Code provides for the promotion of deserving members of the Executive Staff to the Controlling Staff of the Forest Department, and a certain number of officers are thus promoted every year.

It is also, we believe, intended to improve the pay and prospects of the grade of Sub-Assistant Conservators, and these officers will of course be trained at the Dehra Dún Forest School.

The latter School is now fully employed in training a strong Executive Staff for the Forest Service, and to ask more of it, at present, is impossible.

OUR EMPIRE OF RIVERS.*

POLITICAL economists tell us that a Nation's wealth is derived, primarily, from its *Land, Labour and Capital*. But it does not require any prolonged disquisition to prove that, of these, by far the most important is the Nation's Land.

Labour and Capital are sources of wealth subsidiary to, and dependent upon, the fundamental origin of all prosperity—the Land.

People congregate in countries the land of which will yield them necessary sustenance; and whether, as years roll on, sufficient sustenance is forthcoming, or not, will largely depend, as can be indisputably proved, upon the wisdom and skill displayed by successive generations of inhabitants in their management of the soil.

It is one of the most hopeful prospects for the future of the human race—increasing as it is, at present, in number—that there exists tens of thousands of acres of cultivable land that can with ease and with certainty be rendered habitable by the practical exercise of man's intelligence. There are, for instance, tens of thousands of acres of arable land lying waste and uninhabited in certain parts of India, and again is such the case in Mexico, and indeed in other denuded and treeless countries. We all know, moreover, that cultivable lands, even in Great Britain, are offered for sale at the present day, to agriculturists,

* A Lecture delivered by R. T. Cooper, M.A., M.D., at the Balloon Society's Rooms, Royal Aquarium, 16th July, 1886, W. H. Le Fevre, Esq., C.E., Secretary of the Society, (in the unavoidable absence of Earl Caledon,) in the Chair.

at exceedingly reduced rates, and many formerly valuable and fertile properties are now lying idle. Emigration from Great Britain is not a cure for this melancholy condition of things existing in Great Britain, neither is emigration desirable, nor is it required, having regard to population and area. Thus, the total population of Great Britain is only thirty-four or thirty-five millions, while the total area is 69,430,659 acres.

Whether European countries are becoming over-populated, is a question we need not enter upon, more than to express the conviction that, at present, the land of Europe is supporting a population much inferior to that which it could do were it intelligently dealt with.

Properly distributed and intelligently supervised, the labour of mankind is capable of rendering the surface of the earth sufficiently fertile to support a population greater by far than that which now exists.

It is possible for man to neglect or mismanage land to a degree such as will render it unfit to support human life; the fact being that the material welfare and the creature comforts of a people depend in a large measure upon the mode in which land is cultivated, and the amount of care bestowed upon the subject by successive Governments.

Empires have become impoverished and degraded, and prosperity has become a thing of the past to many an ancient people, by whom the conservation of the soil was too little or unwisely considered. Entire districts of Greece, Asia Minor, Syria, Africa, and Spain have been deprived of great portions of their inhabitants; and when inquiry comes to be made we find the departure of man contemporary with the denudation of the soil. Poor Ireland, Scotland and many parts of France have suffered from this cause, and are still cruelly suffering.

If then, not only the decadence of the Imperial greatness of an Empire, but the very existence of the people themselves, is conterminous with the maintenance of a country's fertility, it becomes of pressing importance to attend to and intelligently direct those agents that are capable of exercising a destructive and devastating effect upon the soil.

Water—whether in the form of Rain or Snow, Lake or River—is, in disforested countries, the chief agent in effecting surface denudation; itself the symbol of motion, it flows on for ever, without rest and without fatigue. Traversing its eternal circuit through earth, air, and ocean, it denudes and destroys, or replenishes and supports, in accordance with the condition of the surfaces and channels with which it comes in contact.

Hurtful material is rendered innocuous in the great laboratory of nature by being kept constantly in active and natural movement.

It is obvious we must be continually imbibing germs that were once poisonous, the harmful nature of which has sustained

a change; and the evidence is very strong that this has been effected by the operations necessarily attendant upon their transposition through space. Dirt, Lord Palmerston defined to be "matter in the wrong place;" transpose it into the localities assigned to it by nature, and the opprobrious term becomes no longer applicable.

Here, then, may be said to be the key-note, from a sanitary point of view, to the remarks we are about to make regarding our rivers.

We owe a duty, not alone to those co-eval with us, but more a great deal to succeeding generations, in regard to the maintenance of the fertility of our soil. Our rivers may be said to be the great channels of change, the directing and distributing agents of land-waste; if these are neglected, stagnation and decay, in man and all his surroundings, will take the place of prosperity and progress. Man has been philosophically defined to be the expression of the soil; he thrives and developes coincidentally with it. Woe be to the nation that loses sight of this cardinal fact! Already the master minds of the Brahmins of India are astir; they are determined no longer to sit idly by while they see the glorious rivers with which beneficent Nature has endowed their country—at the sources of which the priests of their great teacher, Buddha, placed their temples surrounded with forests—becoming muddy and impure, silting up and being rendered stagnant and useless.

This is matter of no small moment; for while it touches the sentiment, it very seriously involves the material prosperity, nay, the very existence, of the native Indian community.

The distresses of Ireland are far more the outcome of the neglect of her rivers and mountains and uplands than excited politicians are ready to admit, or than the Irish themselves avow.

Well, the streams and rivers of Ireland have their sources and catchment areas in Ireland, and when the authorities which are supposed to be governing Ireland shall have practically realized the truths contained in this pamphlet, and when the people of Ireland shall be educated in these matters, steps will doubtless be taken to enforce the public production of the Forest Report that was made to Parliament by an educated expert a few years ago. But let us consider a case where the sources of a river—that should be a source of profit and not a source of danger to a country—are situate in an adjoining country, or in still more distant foreign territory. I contend that the people of such a country has a *casus belli* against the people of the country refusing to protect their hills, mountains, and uplands, which should be the life of the river and not its destruction. Some of the chief sources of the Nile are in the lofty but denuded mountains of Abyssinia; others, again, are in the hills and uplands draining into the Lake Victoria Nyanza, at and near the sources of

the Nile. Now, the wealth, and indeed the very existence, of Egypt and Nubia, as habitations for human life, are dependent upon the efficient condition of the Nile. Is, I would respectfully ask, *any thought* being given to *this subject* by Her Majesty's Ministers and Parliament? A petty dispute—which may at any moment become a danger—is, the newspapers inform us, already in progress regarding the charges to be made for water supplied by the river Nile to native agriculturists in Egypt. Again, the Brahmapútra river—silted up to a very dangerous extent—that has only lately been the cause of enormous loss of property and life in Assam, by its flood waters, has its sources in the foreign territory of Thibet. Now the Assamese might with much reason demand that the Lama of Thibet be compelled to conserve the enormous area of hill and mountain land within his territorial charge. Again, the Kingdom of Turkey might demand that the people of Russia be prevented from pouring the wealth of their country—in the form of soil—into the Black Sea and Sea of Azov. The many sources of the Danube and its many important tributaries also form a case in point, and the hills and mountains and uplands draining into the Danube must be strictly conserved in the interests of the peoples of many separate nations.

We need not travel far to be convinced by the most tangible evidence, of the magnitude of the evil created by the absence of interest shown by successive Governments in this all-important question. We have only to make a tour of inspection of the rivers round about London to be convinced, beyond dispute, of the gravity of the evil. We will find that well within the area of the greatest prosperity the world has ever witnessed, exists unmistakable—let us not mince words when we pronounce it—evidence of a nation's decadence. Evidence that is not to be removed by inditing eulogistic treatises upon our lovely *Oceana*, or by the erection of the glittering splendour of a colonial exhibition. Let us look facts in the face, and let us interpret these facts to our advantage.

If any of you will take the trouble to inspect such a stream as, for instance, the Lea, he will, with a little reflection, be soon convinced of the truthfulness of our statement. Its condition, near London, is well known, and has engaged much attention; but the real cause of the unsanitary state of the main lower stream is likely to be overlooked without an examination of its condition higher up. At Broxbourne, for example, I found, in the middle of June, that there were 3 feet 3 inches in depth—of water in mid-stream, as taken from the bridge at the railway station. This, remember, was in early summer. Judging from the amount of silt accumulated at the sides, some 4 feet, we may take it there are at least 10 feet of silt in the middle of the stream.

Now, a river 60 feet broad, if silted up to a depth of 10 feet,

loses in storage capacity for each mile, 3,168,000 cubic feet. (Thus, 5,280 feet × 60 feet × 10 = 3,168,000 cubic feet). This part of the Lea may be accepted as a favourable example of all the streams in Middlesex and adjoining counties, within from twenty to thirty miles of London.

If, now, we inspect the tributaries and sub-tributaries of the Lea, or of the great Ouse, or, indeed, of the Thames, a worse condition of things will be found; for, in many instances, these are disappearing very rapidly from off the face of the earth. The change that has taken place in these streams—I can aver from personal inspection—within the last three years is positively alarming; and, if we Londoners are to be saved the miseries of a water famine, we shall have to interest ourselves very much more in such matters.

What is the reason for all this? It is certain that had our rivers been silting up for the last hundred years as rapidly as they appear to be now doing, many of those existing would have disappeared. Any one who is in the habit of going for a "constitutional" into the fields about London must have often seen the waterway of former valuable streams dried up and useless; and this in close propinquity to a city that needs every stream and every particle of a stream that Nature can supply. It is, however, equally certain that rivers have in the past cut a way for themselves, grooving out their channels in the most dependent situations. They were then what Carl Ritter calls "working rivers" (*fleuves travailleurs*), and carried their silt out to the sea; now, however, the rivers of England and all civilized countries are becoming more and more silt-depositing and inoperative.

Time was when rivers formed the great carrying channels between country and town, and even between nations. The silt was kept in agitation by the traffic. All this is now changed, as Elisée Reclus* remarks: "No river can now be all that the Nile was to the Egyptians, at once their father and their god, the cause from which sprung both a race of husbandmen, and also the harvest which they gathered on the river mud warmed by the rays of the sun. Another Ganges, with its sacred waves, will never again flow over the surface of the earth, for man is no longer the slave of nature. He can now develop artificial roads, which are shorter and more speedy than the roads formed by nature; and this second and even more vital nature which he has created by the labour of his own hands, surpasses his adoration of that first nature which he has succeeded in regulating.

"Nevertheless, rivers will be more important as servants than they have ever been as gods. They bear upon their waters ships

* The Earth, by Elisée Reclus, pp. 444-5. Messrs. Bickers and Sons, London, 1876.

and the products with which they are freighted, and serve as arteries to vast organisms of mountains, valleys, and plains, which are sprinkled over with thousands of towns and millions of inhabitants. They vivify the earth by their motion, carve it out afresh by their erosions, and add to it by their ever increasing deltas."

To render our slothful and silt-depositing rivers active working streams is the problem before us. As things exist, we find our rivers are either insufficiently supplied with water, or the reverse. The reasons of this are obvious. In order to prevent lateral overflow, we bank the river. This of course tends, in conformity with the law of reciprocity of curves, to divert the force of the stream to the opposite bank, and hence both sides have to be alternately banked up. Moreover, if we bank up without removing the silt from the bed, we raise the level of the river, and as nature intended it to take a course as dependent as possible, this, we may be sure, is something that, as the old women say, "*didn't ought to be.*"

Raise the river level, and instead of having the draining of the catchment basin finding its way naturally into the river stream, it will well up in the fields at either side, and the water remaining on the fields will be increased by percolation from the river itself. This means the formation of bog and stagnant water, which in its turn means the growth of rushes, mosses, and inferior grasses. This means inferior forage for our cattle, and therefore a predisposition to cattle disease.

Mr. W. H. Power,* in a recent report issued by the Local Government Board, backed up by Dr. Klein, F.R.S., and Dr. Cameron, has proved that scarlatina arises, in the first instance, from a hitherto overlooked and very trivial vesicular affection of the udders and teats of cows. The origin of many other diseases may be similar; hence the importance, from a sanitary point of view, of seeing that our river channels are deepened, and that the surface waters drain into the rivers, and are thus sent on to distant destinations, and do not lie motionless and germ developing upon our fields.

When flood water becomes stagnant, every kind of evil follows. Dr. MacCabe, the Chief Medical Officer of the Irish Local Government Board, in a recent report upon the state of the river Barrow, showed that when the land is flooded or the subsoil waterlogged by recent floods, the solar heat which should be absorbed by the soil is wasted in evaporating the water, and from this evaporation result fogs along the valleys and cloud-laden atmosphere, which favours a lowered condition of vital power. One of the worst effects, he goes on to say, produced on the health of the inhabitants is that general lowering of vital power always associated with the absence of sunlight. Where

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Vide "British Medical Journal," for May 29th, 1886.

there is an absence of sunlight, a cloud-laden atmosphere and fogs along the valleys, the whole surroundings are depressing, and the result is that the natural vital powers are unable to resist ordinary diseases.

But our rivers are either nearly empty or else over-flowing. So they are, and so they will continue to be as long as we neglect them. Let us, like the priests of Buddha, preserve forests at their sources, and these will afford storage room for the waters of heaven, and gradual filtration into the river stream will be the result. Still more; plant the banks of the rivers, not as at present with stunted unnatural pollarded willow trees, but with fruit trees, with the lovely eucalypti and the towering poplars. This will realise Burns's idea when he thus makes the stream apostrophise the Duke of Argyle:—

> And would my master please
> To grant my highest wishes,
> He'd plant my banks with towering trees
> And bonny flowering bushes.

The effect of trees is most important, for by their roots they give firmness and cohesion to the river banks; they direct the in-coming and the out-going water; they thus promote the flow of surface water and subsoil moisture towards the main channel. Then, by their foliage, they form catchment surfaces for the rain and dew, and prevent evaporation from the river itself, and by reason of the dropping off of their leaves and small branches and seeds and seed pericarps they add to and fertilize the natural humus. Many kinds of trees yield to the earth in six years *their own weight* of material; hence the tree is one of the great agents for the prevention of denudation of soil, and the production of valuable manure. The tree is the origin of the stream, and cannot be divorced from it, and the stream is the origin of the spring quite as much as is the latter the origin of the stream.

From all this we learn the important lesson that if we are to have the Rivers and Streams about London maintained in a natural condition, we must re-forest the high lands and re-plant the river banks; and the same applies to all the Rivers of England, and indeed of the entire Empire.

What, as Londoners, we want, is to have Old Father Thames—

> *Though deep, yet clear; though gentle, yet not dull;*
> *Strong without rage; without o'erflowing FULL.*

That the quantity of water falling upon, say, the Thames basin is quite sufficient for the supply of an immense number of people, can be shown by a simple calculation. Thus, in Huxley's little work on Physiography,* at p. 45, the matter is very simply put:—"What does a meteorologist mean when he says, in his technical language, that the annual rainfall in London is about 24 inches? By such statement he means, simply, that

* By T. H. Huxley, F.R.S., pages 44 and 45.

if all the rain which falls on any level piece of ground in London during an average year could be collected—none being lost by drying up, none running off the soil, and none soaking into it—then, at the end of the year, it would form a layer covering that piece of ground to the uniform depth of 2 feet. The year's accumulation would thus form a vast mass of water. Remembering that an inch of rain represents about 100 tons of water to the acre, it will be found that every acre of land in the metropolis receives during the year, when the year is neither very wet nor very dry, not less than 2,400 tons of rain."

And Professor Huxley goes on to say:—"Looking at the entire basin of the Thames, it may be said that the average rainfall is about 26 inches. Now the area of the basin comprises upwards of 6,000 square miles. Suppose then that we measured out a square space a mile in length on each side; and built upon this a four-sided tower two-and-a-half miles in height, which we completely filled with fresh water; this enormous column would represent the quantity of water that falls upon the surface of the Thames basin in the course of twelve months."

These remarks of Professor Huxley are taken from what, of course, is intended by him to be a mere elementary treatise; nevertheless, they are exceedingly interesting and most important. But I feel sure that inquiries and examinations by experts will clearly prove that the surface-soil off a very large portion of the uplands of the catchment area of the Thames has been, by the unchecked action of rain-water, carried into the river; with the result that an enormous area of its natural channel is silted up.

This disastrous condition of things—disastrous because unnoticed, for while tens of thousands of pounds are being expended upon the maintenance of roads and railways, scarcely a farthing is being expended upon the natural waterways—has to a very great extent been brought about by grubbing up valuable hedgerows, felling timber, and cutting down precious fruit and other kinds of trees, either to extend the area of cultivation or to clear the land for building purposes. Now the natural result of the denudation of uplands, the sources of a river, or the sources of many hundreds of tributaries of a river, is, as before mentioned, that the soil finds its way into the channels of the tributaries and into the bed of the river itself.

I find that 3 inches of soil off an acre of land equals 10,890 cubic feet, and 3 inches of soil off only one square mile of upland equals 27,878,400 cubic feet. Now, Professor Huxley states that 6,000 square miles drain into the Thames; and we all know that a very large part of this enormous area is steep upland. I affirm that the surface soil, by the action of water, has been cut away, and that this will readily account for the terribly and dangerously silted condition of the Thames.

The Thames, at London Bridge, is about 960 feet broad, and

if we calculate for 8 feet only of silt deposit, each mile of river, so silted, shows a loss, in cubical area of natural river channel, of 45,619,200 cubic feet; in other words, this vast area, which ought to contain water, is occupied by silt.

The fact is, that, *at any cost*, the hills and uplands of every country, whether tropical, sub-tropical, or temperate, must, in the public interest, be placed under forest. Reserves of grass, wood, and timber thus created will regulate the flow of water in rivers and streams, prevent the entrance of silt, provide manure for the soil, fruits for man, fodder for cattle, lessen the disastrous action of extraordinary rainfalls, prevent the extension of bog land, increase the quantity of subterranean waters, retain by the action of capillarity the subsoil waters near the surface, provide timber and fuel, lessen the action of destructive winds, be the natural means for replenishing the waters of lakes and wells, lessen the bills of mortality; and, in fine, bring about those beneficial results for countries and peoples that the inspired poet desired when he wrote:—

> "Let your plantations stretch from down to down,
> First shade a country, and then build a town"

The problem for the intelligent community is, of course, how to so utilize the great downfall of rain water that it will prove most conducive to the requirements of the population. And let there be no mistake about it, if we allow the rivers and their tributaries to silt up as they are now doing, our water supply and our agricultural wealth will proportionately suffer.

Our agricultural industries are very depressed, and this depression leads to the neglect of the smaller streams coursing through the fields, the farmer not having the capital to spend upon them as heretofore. These, therefore, get neglected and consequently block up, and they in their turn lead to the blocking up of others, and so it operates until the rivers themselves silt up and become useless.

A telegram was but a few days ago received from India stating that 20 miles of railway were washed away in one night by flood waters in the Punjab, the result of but a few hours' rain. The word Punjab signifies "the land of five rivers"—the Jhelum, the Chenab, the Ravi, the Beas, and the Sultej, the last and southernmost of which was the limit of the expedition in ancient times of Alexander the Great. All these five rivers are silted up, and can hardly be said to hold water. The melancholy but impressive fact stares us in the face that there is scarcely a portion of any country in the world that is not now injuriously affected by its *normal* waterfall.

In vain are rivers artificially banked at an enormous and useless expense; they are unable to hold the normal rainfall, and the tributaries being blocked out by this interference, destructive floods necessarily result.

The poet Burns wrote :—

> Still o'er these scenes my memory wakes,
> And fondly broods with miser care,
> Time but the impression stronger makes
> As streams their channels deeper wear.

But Burns therein considered the natural action only of flowing water, and evidently though an agriculturist, was not aware that long before his day the streams and rivers of his country had deepened themselves to their required depth, and were, when he wrote, in progress of being silted up.

The streams and rivers of countries are no longer *ever* a source of welfare and a profit to countries and peoples as they should be ; but, on the contrary, are now a source of constant trouble, expense, and danger to property and to life.

This subject is thoroughly understood by the people of India, who have forced upon the Supreme Government the necessity of appointing an independent commission—now sitting—of inquiry.

England complains of not being able to elicit from the natives of India what really are their wants. In this particular, however, no such excuse for misgovernment is available ; for the Brahmins have peremptorily demanded that the vast areas of hills and mountains and uplands, the sources of the streams and rivers—the natural wealth and prosperity of the country—which the British Government, in ignorance, leased for cultivation, should be re-acquired by the State by purchase, and replaced under forest.

And here I would emphatically state for your consideration, that the same condition of things which they so powerfully describe, exists not only in India but in England and Wales, in Scotland, and in Ireland, and indeed in all parts of the world with which man has injuriously interfered.

What native opinion is on this subject will be seen to be absolutely unmistakable by the Appeal of the People of India, headed by the Brahmins, to the Supreme Government. And should the day of reckoning ever come upon us, which God forbid, in connection with our lack of duty to the rivers of India, let no hypocritical excuses as to the unfathomable nature of the native mind be forthcoming, when there is on record such documents as this.

The Appeal runs thus :—"The inevitable consequences of the destruction of our natural forests have overtaken us ; our rivers and streams have been silted up, the fertility of the soil on the plains has decreased, the supply of firewood has diminished, the number of agricultural cattle is yearly decreasing, manure has become both scarce and dear, wells have dried up, inundations have been more frequent, and loss of life and property great. Every little shower causes inundations, and after the waters flow over they leave a thick sediment of silt, which

fills up the watercourses and impoverishes the soils thus deprived of their top layer of natural humus.

"The floods near Nowsaree and the Khandesh rivers (of which we heard only the other day, when the water rose to a destructive height after a rainfall of ten hours' duration only) have become the normal type of our present river system. The destruction caused by the rivers Krishna, Kohina, Tapti, Nerbuda, Girna, &c., has inflicted infinitely greater loss on private and public property in a single year than the whole revenue which Government has derived by leasing the hill sides for cultivation could defray.

"There can be no doubt that we should be untrue to ourselves if we did not reiterate our convictions that far more than railways and irrigation works, far more even than our schools and police organisations, the weal or woe of this country depends upon the use we make of our forests.

"Nature has been defied and trifled with too long, and now she is demanding retribution and scourging us with plagues because, by our own acts, we have brought our fairest regions to barrenness and decay.

"We wish the Government of India to appoint a competent Commission to deliberate on these points, and to determine what practical steps should be taken to prevent the further silting-up of the beds of streams, rivers, and inland artificial and natural lakes, and for the perennial replenishment of our wells and subterranean waters."

So much for the Brahmins of India on the subject. The Commission, as before remarked, is now at work.

It were well indeed had we taken to heart and learned a practical lesson from the words of our own Divine Book, ere we commenced to civilize and convert a people who worshipped their forests, their groves, their streams, and their rivers:—

"THE TREE OF THE FIELD IS MAN'S LIFE."

The following is a classification of our Rivers in England and Wales, with their mileage:—

	Miles.
Of First-class Rivers—such as Severn, Thames, Mersey, Wye, Trent, Usk, Ouse, &c., &c.—without their Tributaries, there are in length,	2,670
Of Second-class Rivers, being the larger and more important Tributaries of the First-class—such as the Lea, Cam, Derwent, Little-Ouse, &c., &c., ...	1,660
Third and Fourth-class Rivers, not being Tributaries of the First-class, but having direct flow into Ocean water, ...	1,510
Fifth-class Rivers, being the smaller Tributaries of the First-class, ...	3,900

Sixth-class Streams, being the larger Tributaries of Second and Third-class Rivers, ...	5,990
Seventh-class Streams, being Sub-Tributaries,	37,750
Eighth-class Streams, about.	150,000

That is to say, we have in England and Wales alone some 200,000 miles of river and stream channel, the greater portion of which our masterly inactivity has been improving off the face of the earth!

We have shown that with 10 feet of silt in a river 60 feet broad we lose 3,168,000 cubic feet of the river's normal storage capacity per mile; in the case of the Lea, the silt occupied three times as much space as did the water of the river. In times of heavy rain, therefore, such a river, if cleared of silt, would hold three times more water than it did in its silted condition, before it could possibly overflow.

This calculation for one mile only of river, and this a very small one, serves to show very forcibly why it is that when heavy rains fell last winter so many of our farmers, and of our railway companies, suffered considerable losses owing to the flooding of fields, tunnels, and even dwelling houses.

As a friend writing to me well observed: "It is absurd to cry, '*God save Ireland*,' or '*Parnell save Ireland*.' Scientific education, with work—scientifically performed—will alone save the people of that country, and of many other countries, from poverty, and consequent crime, degradation, and disastrous anarchy."

Let us acquit ourselves like men, and be strong; strong and determined to use obvious and plainly evident means to maintain the soil of the country in a condition fit for cultivation. In order that this may be done, appeal must be made to Government for a Forest Act, and we must point out the necessity for immediately establishing a Department with power over our woods, forests, hills and uplands, and rivers, similar to that in India and other countries, but possessed of greater powers than the Indian Department has hitherto had.

It is ridiculous to cry out about the expense; the goose that lays the golden egg is not to be put out of the way for want of a "ha'porth" of corn; nor do I know of any more appropriate work for our prison labourers than would be afforded by the dredging of our rivers, and the carting away of this valuable material to the fields. Anyway, it is childish to propose emigration as a remedy for distress, at a time when our fields lie neglected for lack of manure, which chokes our rivers in millions of tons. And it is heartrending to observe that while this necessary and remunerative work is to hand the inmates of our prisons, poorhouses, and asylums are employed in competition with honest industrial enterprise. The problem before us is to find sustenance for an ever-increasing population; the country

has to support a present population of over 35,000,000, in contrast with one of 11,000,000 in the beginning of the century. It is said that the truest philosopher is he who can make two blades of grass grow where one grew before. We can show how easily this is to be done.

Let any of you observe in the railway cuttings the slight depth of surface soil that is left for tillage upon our fields, and remember that as time goes on this gets less and less, owing to the denudation effected by rain and by injudicious treatment of the land. Remember also that this valuable humus is being washed off the ground and carried by the action of rain water into our river channels, and that unless it is dredged from these and carted away and distributed upon the fields, ultimate sterility of soil must result.

It will not do to heap up the refuse material upon our river banks, and leave it there, as has been done along the sides of the Lea, till the next downfall of rain washes it back again. No, no, it must be distributed freely upon the fields from which the rain has washed it; and in this way two blades of grass may be made to grow where one grew before.

If we can find money for Egyptian campaigns and for expeditions to Burma, we surely can find the capital needed to regenerate and revivify the uplands, fields, and pasturages of "Merrie England."

Just so; and we cannot obtain the fruits of our labour upon our fields unless we protect the soil and expend labour upon the water-ways of our dear old country.

But there is another aspect of the question. That great and all-powerful agent, electricity, is placing all countries and peoples upon a footing of equality. The power and future greatness of a people will, in consequence of this, be determined, in a great measure, by the distribution and gross amount of its water power.

England is singularly well circumstanced to compete with other nations in this respect. With Wales she possesses, as we have shown, some 200,000 miles of water-channel, the water force of which may one day be employed in developing electric power.

But if we neglect our water channels and our forests it will be but a question of time when the spectacle is presented of Macaulay's New Zealander seated on London Bridge calmly beholding the ruins of this mighty Babylon.

There is yet another aspect of the question. The wear and tear of an increasing population sets free a mass of detritus that is being carried away by air and water, and it is evident that this must lead to an increased accumulation of solid material in our river channels. Just as increased expenditure of time and money is required with an addition to the inmates of a household, so is improved organization and additional Governmental

expenditure required in order to free the outlets of waste when a numeral increase of the population takes place.

The task is a mighty one; but the expenditure, if judiciously undertaken, will amply repay itself, and an immediate return may be looked for in the happier and more prosperous condition of the country. If the Augean stables are to be cleansed, let not the *fiat* of impossibility go forth, but let us set about the practical accomplishment of a purpose that will secure for us of to-day the gratitude and blessing of our children, and, in the future, of our children's children. Let a policy of dirt and slothfulness and ignorance—for it is nothing else—give place to one of cleanliness and activity, and of *power:* this and this only will bring happiness and prosperity.

One cause at work the present day in contrast with the past, powerfully operative in setting free detrital material, is our network of railways. It is ridiculous to suppose that we can have the country interspersed with hundreds of lines of railroad, and can drive ponderous coke and coal burning engines, pulverising material and distributing dust in every direction as they roll along with lightning speed hither and thither over the surface of the country, without an injurious influence being exerted upon water channels.

This is a point that has been insufficiently dwelt upon, and that most certainly is worthy of consideration, because it lends weight to the argument that our streams are silting up more rapidly now than in former days.

Almost every old fisherman can testify to the disappearance of streams that in the times of his boyhood afforded him many a healthful and remunerative day's sport.

If we set matter of any kind in rapid motion, wear and tear will result; and this must obviously be associated with the dispersion of material particles through the atmosphere; many of these must, in the nature of things, be washed into or blown down upon our water surfaces, and hence an addition will be made to the ever accumulating silt.

More than this, railways exert a most pernicious influence upon the free flow of water to the river channels. For in crossing the catchment basins of rivers, they form impassable banks that impede the flow of surface water, and thus shut off the water of extensive areas that formerly constituted a source of supply to the river.

All this goes to show that the system of management of the country—if we can be said to have had any system—which may have been tolerable in the past, may, for very cogent reasons, be wholly unsuited for the requirements of a generation of matter-agitating beings like ourselves. And it affords a complete answer to those who are ever ready to argue that as our rivers needed no care in the past, they can be left equally uncared for in the future.

I have already stated that the total aggregate length of river and stream channel in England and Wales is upwards of 200,000 miles. This does not include the lengths of lakes, which natural high level basins are frequently the source of important rivers, and, along with our many artificial canals, require most special attention. And I have stated, and am prepared to prove, that the greater part of the original river and stream channel has silted up. Now, to set to work and to deepen this enormous length and breadth of channel, will not only be an exceedingly expensive work, but will give employment to every available working man in the United Kingdom. Yet we learn that "during the six months ending June 30th, the persons of British origin who left the United Kingdom for places out of Europe, numbered 112,227." But men and money must be forthcoming for this work, in this and in every other country in the world; for the same melancholy and dangerous condition of things exists in every country.

We know that, through ignorance, the willows which used to line the banks of our streams in countless thousands, have either been destroyed or ruinously pollarded—and thereby diseased—to death. The power of capillarity of this family of trees is simply enormous.

> The torpid SAP, detruded to the root
> By wintry winds; that now in fluent dance
> And lively fermentation, mounting spreads
> All this innumerous coloured scene of things;

favours the flow and storage of underground moisture, thereby fertilizing and improving the soil. Landholders might now set to work and replant the willow, and cherry and other edible fruit trees, along the upper banks of their river lengths.

This will at once, amongst other things, produce revenue, increase the level of the upper banks of the rivers, give valuable edible fruits for consumption, provide timber for building, and do away with the necessity for exporting English gold to foreign countries for fruits which can be readily grown at home, with lasting benefit to the country. Quite recently, the *Daily Telegraph* stated that "as many as ten thousand baskets of cherries were landed from Holland in one day, of the value of three shillings and fourpence a basket." Here then is a loss of £1,700 per day on these small importations alone, while a vast portion of the produce so imported finds its way into cesspools that are permitted to pollute our rivers and streams.

While the value of land in this country is annually decreasing, and numerous farms remain unlet; while floods in every country are inundating lands, ruining crops and destroying men and cattle;—an instance of which occurred recently in Hungary, the rivers Temes and Bega having inundated a large district and destroyed two villages;—we find that the Government of Spain is proposing to raise money for monarchi-

cal and ecclesiastical expenditure by the sale of her natural forests.

The statements made, though applicable to all parts of our Empire, are especially so, be it noticed, to those least securely held; namely, Ireland and India.

The condition of the river Barrow, in Ireland, has lately formed the subject of inquiry, and the estimated expenditure required to restore it to a navigable and efficient condition amounts to over £474,000, and this it is proposed to fix upon the owners of the adjoining soil. But it is evident the question is really a national one; it is not the Barrow only, but all the rivers of the Empire that cry aloud for attention, and the money needed for the work must come from the entire population.

It will not do to undertake the work in a halting, fitful, and piecemeal fashion. An extensive and well-directed scheme ought to precede the inauguration of an executive Department, having power over our entire *Fluviana*—our EMPIRE OF RIVERS.

SISSU PLANTING IN THE GORAKHPUR FORESTS.

As the sissú plantations in the Gorakhpur forests are pretty extensive, and have been very successful, a description of them and the method of planting will no doubt be acceptable to the readers of the "Indian Forester."

Locality.—The situation of the ground selected for planting was a tract of grass land on the outskirts of the Sonari forest at Sukhwi, North Gorakhpur; it lies between two rivers, the Rohin and Pyas, which are at this part, from one to one-and-a-half miles apart; both of them have their source in the Nepál hills, and both overflow their banks here in the rains; both are very winding, and their beds have little slope, their banks, which average about 15 feet high, are in general covered with jaman trees.

Character of ground.—The surface of the ground undulates, and in consequence of this, the low parts are covered with water to a depth of 5 feet in the floods; the water marks on the trees are very distinct, showing that the water remains at that height for some time. In the rains of 1883, the spill water of the great Gandak got into the district, and half of the plantation was under water for two months. There are a number of old river beds, all over the tract, these have no outlet, the water in them is from 3 to 5 feet deep in the cold weather, and about 10 feet in the rains. These beds are filled with jaman trees growing in the water, and on the banks, scattered all over the ground, are a few good sized trees of padal, simal, haldu, and a few other kinds. The surrounding forests are of sál, and the fact of these grass covered tracts occurring in almost pure sál forests, shows that they are not adapted for natural

forests; most likely this is owing to their being frequently under water. The well on the highest part of the ground, where the forest chauki has been built, has in the cold weather the surface of its water 18 feet below that of the ground, while in the rains it rises to within 2 feet of the ground.

Character of soil.—The soil is yellowish in colour, and is a mixture of clay and sand, in which the clay seems to predominate; it is good brick earth, in rests on a substratum of sand, the sand is found at various depths, but the average is about 15 feet.

Why sissú selected.—In the Gorakhpur district sissú is rare, only on the sandy islands in the Gandak, which borders the district, are there any quantity to be found, and as this wood is the best for general and agricultural purposes, planting it will not only benefit the district, but benefit the forests also, for a well grown sissú tree 30 years old is worth Rs. 30, for timber and firewood.

Nursery.—At first, the plants were carted from nurseries in Rámgarh, a distance of 60 miles from Sukhwi, afterwards the plants were raised at Sukhwi itself. The ground for the nursery is well dug up for 2 feet deep, and ridges are thrown up 2 feet apart centre to centre, the seeds, selected from good healthy well grown trees, are then sown pretty thickly on the top of the ridges, and covered with earth in the usual way. They are sown in March, April, and May, and are regularly watered till the commencement of the rains, at the end of the rains, the plants will have the tap root up to 6 feet long. Some that were being planted in February last were measured as they came to hand; they were sown in May 1886, but their growth had been somewhat retarded owing to the nursery being under water for sometime in the rains. These are their dimensions—

Dimensions of plants.

	Length of tap root.		Diameter of stem at ground.	Length of stem.	
	ft.	in.	in.	ft.	in.
1 plant	5	7	¾	4	9
1 "	4	9	⅝	4	4
1 "	4	5	⅝	2	11
1 "	4	5	½	3	11
1 "	5	0	½	3	3
1 "	4	6½	⅝	3	1½
1 "	4	2	⅝	2	11
1 "	4	3	½	3	9
1 "	2	9½	½	2	6
1 "	3	6	⅝	4	6

Preparing the plant holes.—These holes are 3 feet diameter at the top. 2 feet at the bottom and 3 feet deep; they are dug before-

SISSU PLANTING IN THE GORAKHPUR FORESTS.

Fig. 3.

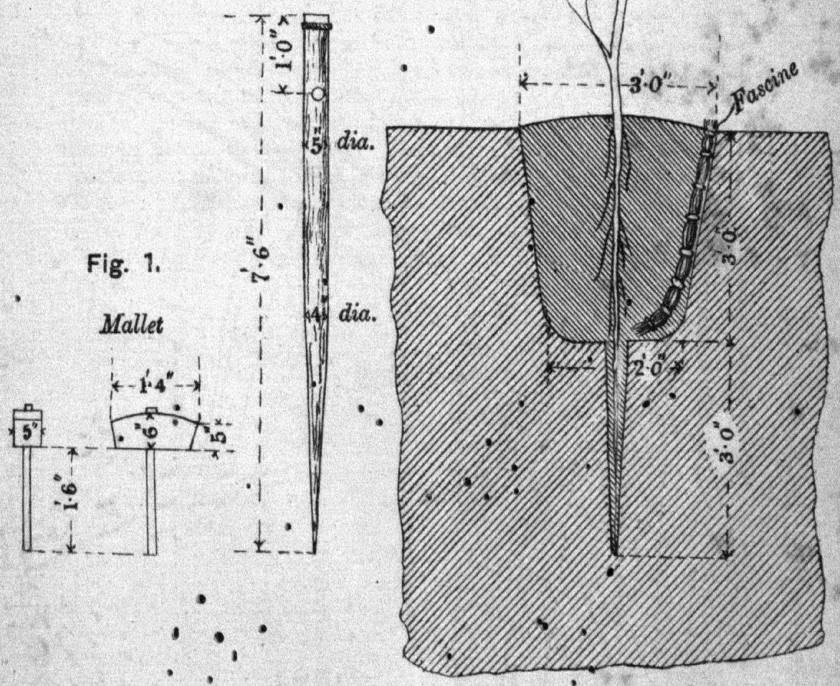
Sissu Plant in Ground.

Fig. 2.

Stake

Fig. 1.

Mallet



Litho. T. C. Press, Roorkee.

THOS D. BONÁ, *Supdt.*

hand at the regular distances apart, the tool used in digging them is the ordinary phaorah, or kodali, as it is called in the Gorakhpur district, the handle is used short, 18 inches over all; it might be thought at first that the men would find some difficulty in digging a hole this size, but it is surprising to see how deftly they clear out the bottom of the hole, they do it apparently as easily as digging in a trench of the same width.

Fascines.—A fascine of coarse grass 4 feet 6 inches long and 4 inches diameter, tied together with grass every 6 inches, is prepared ready before the planting commences, this is used to conduct the water to the bottom of the hole as shown in *Fig.* 3.

Tools.—Besides the phaorah, the only tools required are the stake and mallet. The stake is made of sain or asina (*Terminalia tomentosa*), of the shape shown in *Fig.* 2. It is 7 feet 6 inches long, 5 inches diameter at the top, and tapers as shown. The top is bound round by a rope made from the Bauhinia creeper (*Maljhan*), the rope is put on wet, and on drying, it shrinks and tightly binds the top of the stake, and helps to keep it from splitting: one foot from the top a hole 2 inches diameter is bored through it. When the stake has been driven to its full depth, a bar is placed in this hole, and the stake turned round to loosen it and enable it to be drawn out easily. The mallet is as shown in *Fig.* 1; it is the same as the mallet used for driving in tent pegs, and is made of sál, as this is the wood easiest procurable: sissú makes a much better mallet.

Digging out the plants.—This is the most difficult of the operations connected with the planting, as it requires men trained to do it carefully, so that none of the roots are damaged. At Sukhwi the operation commences by the digging of a trench 6 feet deep at the side of one of the ridges on which the plants are, the earth is then removed carefully from the roots, and as each plant is taken out a stout stem of grass is tied to the root and stem, and the plant laid on some damp grass on a stretcher or hand barrow. When enough are dug out, the plants, covered with more damp grass, are carried to the holes prepared for them.

Time for planting.—As stated before, the planting was done at first in the rains; the success was everything that could be desired, but as the forests during the rains are unhealthy, and as it was found that the planting could be done as well in the cold weather, it is now done during the end of October and in November, December, January, February and the beginning of March.

Method of planting.—The holes being dug, the fascines made, and the plants carried to the holes, the planting commences. First the stake is taken and thrown down the hole, striking the bottom of it fairly in the centre, it is then driven down by the mallet, till it is 3 feet below the bottom of the hole, a bar is then placed in the hole at the top of the stake, and the stake is

twisted round till it is loose and can be easily drawn out. The plant with the root tied to the stem of grass, is then lowered into the hole made by the stake, and a stick is placed at the bottom of the large hole, and inclined towards the stem of the plant, both are held together by the hand. The stick forms a rest and enables the plant to be held firmly. The fascine is then placed at the side of the hole, *see Fig.* 3, and the earth is then carefully filled in. When the hole is two-thirds full of earth, two gharas full of water are poured on it, this consolidates the soil around the roots of the plant, the stick is then drawn up, and the remainder of the earth filled in; one ghara of water is then poured on the top of the earth and another down the fascine, this ends the planting.

Watering.—By means of the fascine the water is delivered 3 feet down from the surface of the ground; during the cooler months one ghara full of water is poured down the fascine once a month, in the hotter months once in three weeks; this is continued till the rains commence, after which no more watering is done. The gharas are about a foot in diameter, and are spherical in shape.

Growth.—The grass grows very rapidly and thickly during the rains, and the plants have to contend against it. On the higher lying ground they soon get above the grass, but on the low-lying parts the flooding keeps back the growth of the plants, while it favours that of the grass. The loss here through plants dying is estimated at 20 per cent. before they become finally established, while on the higher ground the loss is only about 4 per cent. The height of the trees are much the same for those planted at the same time, but the diameter varies a good deal. Of those planted in July 1881, the following are the heights and girths of some of the largest :—

Height.	Girth 1 foot above ground.	Girth 3 feet above ground.
feet.	inches.	inches.
43	38½	32¾
45	36	32
44	34½	30¼
45	33¾	30¾
45	31¾	29
43	30	25
48	26½	22½

This is very good growth for trees 6 years from seed.

Character of the wood.—The value of sissú depends on its heartwood, which is very like rose wood, it is very strong and

hard, works well, and takes a beautiful polish. Whether there is any heartwood or not in these young trees cannot yet be ascertained without cutting down some. Search was made to see if there were any dead and dried up trees that could be cut down and the section examined, but none could be found; this says a good deal for the health of the plantation. One tree of small girth was blown down at the beginning of the rains of 1886, its height was 35 feet and girth 20 inches. A section of this when polished showed clearly 15 rings; the tree was 5 years old, so each year has three rings. These no doubt correspond to the spring rains and autumn growths, and show how fallacious is the system of estimating the age of a tree by the number of rings in its section. Botanists, however, are now beginning to recognize this fact. The wood of this small tree was hard and firm, but it had not become very dark coloured, though the exuding of black pitch from a crack in the centre showed that the transformation was beginning.

Cost of planting.—The digging of the plant-holes is done by task work, one man digs 20 holes for 2 annas, but when the earth is very hard only 16 holes are done at that rate. The digging up of the plants, carriage to site, making the fascines, planting the trees, and watering them at the time of planting, costs just double this, that is, the number of men who will dig 100 holes, will only dig up the plants for and plant 50 trees in the same time.

Up to date, the total cost of one tree established has been one anna. The trees have been planted at three different distances apart; at first they were put in at 15 feet apart, then at 30, but now 21 feet apart is being worked to. The distances give respectively 193, 48 and 100 trees per imperial acre.

Area planted.—The following is the area planted during each year. Commencing from—

		Acres.	
July 1881,	.. ..	20	15 feet apart.
"	.. ..	60	30 " "
1882,	.. ..	220	30 " "
1883,	.. ..	250	21 " "
1884,	.. ..	800	21 " "
1885,	.. ..	450	21 " "
Estimated 1886,	.. ..	230	21 " "
	Total, ..	2,080 or $3\frac{1}{4}$ square miles.	

The entire plantation is divided up into suitable blocks, by roads 20 feet wide; these are kept clear of grass, and act as fire lines; the trees on the sides of the roads are planted closer together, to kill down the grass there and to give plenty of shade. The 60 acres first planted at 30 feet apart, have had tún and khair planted between the sissú; the tún has done as well as the sissú, but has suffered much from the nilgai eating it.

Financial results.—It is yet too early to get any return from the trees, but there has already been a large sum realized from the sale of grass for thatching purposes. The preserving of the tract from fire has increased the growth of good grass, and it now brings in Rs. 2,000 per annum, though formerly the grazing dues did not average more than Rs. 50 per annum. As the trees grow bigger, the grass will be killed down; there are already signs that this is being done under the trees first planted.

Conclusions.—This plantation of 2,080 acres, or 3¼ square miles, is not a small struggling affair, but a large successful plantation. Captain Wood's theory of planting was that the plant should have its tap and other roots entire; that it should be planted in a good mass of loosened earth; and that the water should be delivered at the roots, some considerable distance below the surface of the ground. When the plant has its roots entire, it can draw nutriment from a greater area of soil, and when a good mass of the soil is loosened and mixed with the surface soil, the lateral roots can more easily penetrate it, and so get better nourishment. The tap root going well down, makes the tree firmer in the soil, and by getting into a damper region keeps the plant alive; if accidentally the giving of water to it is missed at any time, the sub-soil watering gives the water at the very place where it is wanted, and as none is put on the surface, the soil there keeps in good condition for the influence of the air to act on it, and the water being given in such a favourable place, makes a few waterings only necessary in the dry weather to keep the tree growing vigorously, till the rains come on. That this system of planting has to do with the quick growth of the trees, can be seen on comparing those in a plantation on somewhat similar land at Mundowlia, 12 miles south of Sukhwi. There the trees are 13 years old, the area is about 1¾ acres, they were planted in the ordinary way, and were watered constantly at first, and though the cost has been very heavy, yet the largest tree has a girth of only 38½ inches, at 3 feet from the ground, only a little larger than the ones of 6 years old at Sukhwi, while a great number are much smaller than the smallest at Sukhwi of that age.

The details of the different operations necessary to carry out Captain Wood's theory have been carefully and zealously worked out by the Assistant Conservator in charge (Mr. Alex. Campbell) and the Ranger (Roghá Náth Rathák) by his attention and good arrangements for labour has contributed greatly to the success.

DATES IN JEYPUR.

I AM extremely glad to hear that the Durbar have sanctioned

* Copy of a letter from Brigade Surgeon E. Bonavia, dated England, 18th January, 1887, to Lt.-Col. S. S. Jacob, Exec. Engineer, Jeypur.

half a ton of date palm seeds. Your plan is a good one, that is, offering an inducement to the people for growing and taking care of them. You will have been a great benefactor to the Jeypur State. You should, however, I think, keep a nursery under your own eyes. Seeing is believing, and natives are slow in believing and caring about results they have *never* seen. Like children, things must be done for them until they taste the advantages, and then no one is quicker in taking up a thing. As to procuring the seed, there are many ways. Either applying to the Government of India and they will get seed through the Persian Gulf Resident. They have lately sent ten maunds of seeds and 230 offsets of four of the prime varieties to the Central Indian Agency and a similar amount to the Punjab Government. Offsets should reach you in October, while seeds need not reach you till February, and this will give more time for collecting the seed. Seed is not utilized in the Gulf, as they have innumerable ready-made offsets of the *best and most valuable varieties*. So that, in the Gulf, they have some difficulty in sending seed without due notice. Write now and get what you can through Government. Then you might write to the Political Resident, Persian Gulf at Bushire direct, and also to Messrs. Gray, Mackenzie and Co., Busrah, for seed. The kinds most valued in the Persian Gulf are "Hellowi," "Khudrawi," "Zehdi," "Samran." The latter, a hardy tree with excellent fruit.

Hallowi exported to Europe are the most highly priced and esteemed, because of flavor, and "because they do not get wormy when packed in boxes," and Zedhi fetches the highest price in Bombay. Then Mr. Duthie of Saharanpur may be able to help you with imported seeds. He has undertaken large plantations of nurseries of date trees of all sorts and from all countries. Then Mr. Ridley of the Horticultural Gardens, Lucknow, may be able to help you with seeds of his acclimatized varieties, both of offsets and of seedlings. He can send you the fruit before it ripens or as it is ripening. Before fully ripe the seeds germinate equally well. Seed sown in winter may not germinate till February, and that sown in February will germinate in a fortnight or so.

Further, at the suggestion of the Director at Kew, I wrote to Sir R. Lambert Playfair, H. B. Majesty's Consul General, Algiers, and explained to him our Indian wants, as they thought there were great difficulties in sending seeds and offsets from the south of Algeria; they have saline oases, where date trees are grown, and nothing but date trees thrive in that soil! I heard from Sir Lambert yesterday. Hear what he says: "I only returned from the Djerid (in Tunis) a few weeks ago. I superintended the selection of the date seeds in person, and am about to return to Tunis in a few days." The seeds have been sent to the Government of India. Apply for a portion of them. The Djerid variety of dates is said to be the finest in the world.

He adds: "Really there is no necessity of sending offsets, although from what you say, there would be no difficulty. Seeds are sure to germinate, and the experience of the Arabs here (Algiers) is that the fruit of seedlings is quite as good as that of trees propagated by suckers. The only difficulty is that seeds give a large proportion of males than *needed.*" Please note the above underlined word. Never believe what they say in the Persian Gulf about seeds. Seedlings in Oudh have produced fruit equal to suckers! I sent a fine collection of date fruits from seedlings to Kew just before leaving India. In the Persian Gulf, they despise seeds because they don't need them. in the same way that in India good mango stones are despised, because they have any number of grafts of the best kinds. There in Egypt they have upwards of 50 varieties of dates. Some grow in dry places, others in damp with a good deal of cultivation. As I crossed the Isthmus of Suez I saw date trees of which fruits had been recently gathered with their roots in *water.* Everywhere water was within one foot of the surface; the inundation apparently had just been receding. The best Egyptian date is a small one and is like sweetmeat. Write to any of the Egyptian Canal Officers (all of them Indian Canal Officers), or to the British Consul in Alexandria, or to any English Officer you may happen to know there. You cannot have too many varieties to begin with, and import a lot of seed every year. When the Persian Gulf people know that seeds of good dates are wanted, they will collect and keep them every season.

From September (ripening of crop) to January, they can collect you maunds of seed every year. The Director of Kew, writing to me recently, says: "I am sure the enterprise (introduction of date trees in India) you have undertaken is a sound one, and I have done my best to back you up. You have set the ball rolling, and it must now rest with the botanical officers in India (and others) to keep the game going." Sir Lambert Playfair is an old Indian officer and a good gardener himself, and will help in the enterprise with great pleasure, so write to him. "Although," he says, "I have already sent off the first supply *enough to plant half India.*"

He, however, may have forgotten that India is overrun with goats and cattle, which in dry seasons eat up *everything* they are allowed to, and natives are apt to leave everything too much to God! So for the next 10 or 15 years, pray never relax your efforts to *obtain seed* and to *plant* and to *protect.* You will be the great benefactor of Jeypur. The thing is not to be done at once, but steady persevering work is required and an indomitable *will* not to be *beaten.* The thing is to be done without much trouble. In my opinion seed is the best for general use. *The more the males at first the better.* Until Natives understand the tree as well as they now understand the wheat growing, then of themselves they will make plantations of offsets of

their best females only, and artificially fertilize with pollen of a comparatively *few* males. There is time enough for that. What is wanted now is to get the seed, sow it, nurse the plants, plant them out in plantations and protect them till they are out of reach of harm. This is to be done every year until all spare land at Jeypur in every village is *filled*. The cultivated trees produce the best and finest fruits. Offsets being expensive should, I think, be limited to nurseries and plantations at head-quarters. In the hot weather, they will be given frequent watering to grow rapidly. I hope you may also induce the other States of Rajputana to follow your example. If you could lithograph this letter, you might circulate it among them *privately*. I think if the matter were taken up by the whole of Rajputana, in 10 or 15 years, that tract of country would be a different country, and its saline oases are favorable to date tree growing.

There is another plant which I wish now to recommend *strongly* to your notice and care, namely, the *European Prickly Pear tree* (a Cactus). You have hedges of the wild varieties. Nurseries of the latter might be made and European varieties grafted on the wild ones. It grafts with the greatest ease, and might also be raised on its *own* roots, like the wild ones, with a certain amount of care. For rough rocky soil, where water can be given to the trees, round tanks, &c., the cultivated variety produces admirable and delicious fruits. In Malta, the best varieties are to be had—to be obtained through Government. They are usually grown in *private* gardens, *viz.*, the *white*, *red* and *yellow* fruited varieties. But it is grown largely in Egypt, Sicily, South of Italy and in Spain, and probably all along the Mediterranean. Some time ago, I *urged* the Madras Government to give it a trial. They have done so, and introduced it into Bangalore and other places. In South India, the wild prickly pear grows everywhere, and hedges are made of it; it bears a small red and rather tasteless fruit which natives eat. Mr. Steavenson, the Honorary Secretary, Agri-Horticultural Society, is very keen on *prickly pears*, and may send you some of his imported kinds; also Superintendent, Mysore Government Botanical Garden, Bangalore; also any English official in Egypt. The cuttings are bat like pieces of the stem; should reach you in October *after* the rains, as too much *before* rooting might rot the soft cactus substance, but perhaps in Jeypur, where you may not have much rain, the rainy season would be preferable. Try to get them *now*, in the *rains*, and also *after* the rains. Your Jeypur stony soil, with a little digging, manuring and watering to give the prickly pear trees a start, might prove admirably suited to this plant. Udaipur and Ajmir, besides Jeypur, have taken date offsets, also from Saharanpur. You can get seeds of good Mooltan dates and also of Sindh dates from Karachi.

E. BONAVIA.

A NEW SPORT.

THERE is a constant cry from our friends of the rod and gun that sport is overdone, that there is little or no game left except for those who are fortunate enough to have time and money to spend in going miles and miles a-field. Any particulars of a new sport will I am sure be welcome; gird up your loins then brother foresters, surfeited with the slaughter of countless tigers, bison, &c., here do I gratuitously offer you an entirely new sport in no inaccessible region! As a rule the sportsman who is fortunate enough to find some nice little corner where game is plentiful and big bags of daily occurrence, is most careful to keep this sacred spot a secret from even his most intimate friends, well he knows the result of letting the cat out of the bag. But I will let no such selfish feelings deter me—come sportsmen (foresters or no), come all who can, bring your friends if you like (in fact I would advise you to do so), and enjoy the sport whilst you can. At present the game is unprotected by any Game Laws, any one is at liberty to roam at will from one end of the country to the other; but in two or three years it will be protected, not on account of its scarcity and the risk of its extermination, but because of its utility to mankind—for much the same reason as the elephant is now protected in India. At the moment at which I write the game is in such abundance and so destructive in its habits that no protection is thought of.

The country which this beast affects is one of the most fertile; it is well watered by one of the grandest river systems in the world; it is peopled by one of the most lazy and easy-going of races; provisions of all sorts are obtainable at not too exorbitant rates; labour, although dear, is not extravagantly so, the climate, although trying to Europeans during the hot weather and rains, leaves nothing to be desired from December to February. It is essentially a country of forest and stream, the timber that it produces is far-famed, and when the Forest Department shall have spread its branches over this network of streams and ridges the Chancellor of the Exchequer's post will become a sinecure.

"But where is this Elysium, this happy hunting ground?" ask our sporting friends. Wait a minute, I must tax your patience a little longer with a rough description of the animal's habits so that you may know what to expect, and in what sort of battery to indulge.

The jungle in this Elysium is very thick, and the game is almost invariably met at close quarters, so that a rifle warranted to hit a postage stamp at 1000 yards six consecutive shots (if held straight!) is not an absolute necessity. The species is gregarious, and the animals go about in herds numbering from five to several hundreds; they are most pugnacious, and if come upon suddenly will almost certainly attempt to "go for" the

intruders. But they have no pluck, and if worsted at the first onset will generally turn tail and bolt off into the jungle. They are not very large, weighing on the average about 120 lbs., so a heavy bullet is not required. The only weapons I should advise are a ·44 Winchester Repeater and a ·455 Revolver to take Government ammunition; these should both be carried by the sportsman himself on all occasions.

I am sorry to say that personally I have not bagged a single head yet, but I have seen the beasts both dead, wounded and in captivity. Forest officers in this Elysium are usually so hard worked (I don't mean for a moment that we have a monopoly of this commodity!) that there is little or no time to go in for shooting systematically. I believe some of our foresters have been out in a desultory sort of way—one, a gallant military officer, got a fair open shot at a herd and brought his quarry to bag, another was knocked down before he had a chance of using his gun, but these are about the only cases of which I have heard. In fact, by Forest officers, they are regarded as a nuisance (O smile not ye tiger slayers!); with never the time to organize a proper hunt and beat the jungle you are at any moment liable to be charged from behind an innocent looking tree by these pugnacious brutes, and then woe betide the man who is not on the *qui vive!* The inhabitants of the country have a superstitious horror of them, and will bolt at the slightest sign of their being in the vicinity, leaving their poor sahib to his own devices. To such an extent do they carry this superstition (?) that whole villages have turned out with offerings of rice, plantains, &c., to try and propitiate the wrath of these (to them) terrible beasts rather than try and drive them away.

Owing to the thickness of the jungle, but little success has as yet been obtained in tracking these brutes, for they will travel 40 and 50 miles in the 24 hours when pursued. The natives of the country are useless as shikaries, and having, as I have just said, a superstitious dread of these "Damya" (for that is the native name of the wily brute of which I have been telling you), that they are not much good even when the game has been started. I believe the experiment of importing skilled trackers from India has lately been attended with some success, and I would recommend any sportsman who thinks of visiting these regions to engage one or two trackers before leaving India; I am certain the results would be worth the extra expense.

Just one more tip and then I can say that I have done my best to help you—bring your own ammunition if you wish to go in for a little bye-sport with the duck and snipe, which of course is excellent in this sportsman's "happy hunting ground." The gunpowder usually sold in our principal towns is..... well, you shall judge for yourselves, for it passes my powers of description! Not long ago I sent down for 6 lbs. of C. and H.

No. 6; the reply came they were very sorry there was no C. and H., but they sent 6 lbs. Hall's FFF., the only sort obtainable. In due course the powder (save the mark!) arrived; the first canister I looked at had been eaten through by rust (or white ants!) in about 20 places, and contained one large solid cake of some hard reddish-looking substance, which had to be pulverized with a hammer before it could be got into a cartridge. Being the only stuff available I had to use it, but as I have never yet managed to hit anything with it, I cannot say what sort of penetration it gave. The other five canisters were all up to this sample.

And now having so generously and gratuitously given you all the tips I can, there only remains to tell you where to go and to speed you on your way. By the bye, if you would like to see a specimen of the Damya in captivity before coming to Elysium, there are one or two specimens in captivity at Pondicherry, and several more, both male and female, at Ratnagiri, but if you would hunt this wily denizen of the jungle in his native haunts, you must take passage to Rangoon, and apply to the Inspector General of Police, or any other officer, Civil or Military, who will I am sure be only too glad to give you the latest khaber of the largest herds of Damya, or Burmese "Dacoits." Good luck to you!

FOREST GUARD.

CLEARING CONTOUR BANDS THROUGH DEODAR FORESTS.

IN the Punjab Annual Report for 1885-86 is mentioned a system of clearing contour bands through deodar forests to aid natural reproduction. The Government of India in reviewing the Report has requested that "practical effect should be given.....to the proposal.....for clearing contour lines of shrubs and grasses in suitable localities." I am, however, at a loss to know how, or in what places, it should be tried, nor do I at present see, what greater benefit can be derived from it, than from the various methods in vogue in the Chamba forests (which are prescribed in the working plan of the Upper Ravi forests), and shall be glad if you can enlighten me. In Chamba the forests may be roughly classed as exposed, and sheltered. The former class contains deodar more or less pure, there being a very small admixture of oaks, horse chestnut, &c.; the latter class comprises forests situated on the sides of deep, dark ravines, in which the deodar appears almost only on the crests of the spurs, almost pure, while the smaller ravines have hardly any deodar, generally containing chiefly horse chestnut and other inferior species. In the first class, our plan is to cut such deodars as oppress the young growth, clear out all

inferior species, and work up the soil around isolated seed bearers, besides planting all large blanks far from seed bearers. In the second class the inferior species are cut out, only from among or near the deodar, as far as it is likely the seed will fall, and the soil is also prepared or worked up; near seed bearers large blanks are planted. Such being the case, it is not understood where the contour lining can come in with any advantage; for, in the exposed (or pure) forests there is very little to cut out, and in the sheltered forests our plan is, it would appear, much more thorough and systematic; as all inferior species are removed from the vicinity of the deodar, and full scope is thus given for natural reproduction of deodar alone, wherever possible. In the case of contour lines, it seems to be quite as likely that inferior species will be produced in the lines, as deodar, seeing that, presumably many seed bearers of these kinds will still remain above the lines; whereas, under the plan of cutting all of these, nothing but deodar should be produced in the cleared spaces. Again, if the contour lining be successful in producing a growth of deodar, surely a very patchy forest will result. The lines alone will contain deodar, and eventually the forest will consist of mere bands of deodar with the intervening spaces covered by a forest of inferior species. If these lines or bands are very close together, then it is nothing more than our plan of removing inferior species; and to attempt to keep down all inferior growths, whether of trees, shrubs or grasses would, if done on a large scale, be enormously expensive, and be suspiciously like that "gardening" on which such large sums have been wasted in the past. There is no doubt that deodar reproduces itself very well if fires and grazing are put a stop to, and if to this be added a system such as I have described, it would seem that all is being done that is necessary to secure the end desired, and these measures are free from the objections of being partial and unsystematic, objections which I maintain, apply to the method of making contour bands, which can only, in my opinion, result in a very irregular forest. It will no doubt be of service to us, if the advocates of this plan will be kind enough to explain where we can employ it, under the circumstances above mentioned, in the Chamba forests.

J. C. McD.

GERMINATION OF BABUL SEEDS.

"G. J. v. S." in the February number of the "Indian Forester," seems to challenge information as to whether 'babul' seed is improved as a germinating seed by being passed through goats, and whether any kind of seed can be so benefitted by being passed through birds?

As regards 'babul,' "G. J. v S." is perfectly correct in his surmise, that *babul seeds* are not passed from the mouth to the anus of goats. Babul seeds seldom or never do pass completely through the goat, though they do through individuals of the bovine species. What happens in the case of the goat is this—the whole pod, seed and all, is eaten and goes into the first stomach, then follows fermentation, which often, if not always, precedes the hour of rumination. Rumination as a rule takes place where the animals are herded, *i.e.*, where their dung is collected. Here if anyone will take the trouble to watch a goat, he will see it, during the process of ruminating, spitting out the seeds, which naturally fall amongst the dung and get swept up and stacked with it by the shepherds.

"G. J. v S." now infers that the benefit the seed attains, *viz.*, that of being able to germinate quicker than ordinary seed, is due to the place where it falls. Here I take objection, and would ask him to try the experiment of placing a few ordinary babul seeds in a similar situation, and he would find that a very larger percentage would not germinate at all until the usual course of two hot weathers had been passed over. Whereas nearly every one of the quidded seeds would germinate in the first monsoon. It matters not how soon after quidding the babul seed is removed from the dung, it is always the same good germinator.

I have heated, both in manure and water, babul seeds, and find that by gentle heating it often happens, that you can get seeds to germinate at once, but being an operation in which the temperature may by accident be carried too far, or not far enough, failure to germinate often ensues. Whereas this cannot take place in the stomach of the goat; this is a process that can never be altered, and consequently never fails.

With reference to birds, I know the case of the *Melia Azedarachta*, the seeds collected by me specially for plantations were those which bore unmistakeable signs of having been through a bird's stomach, and as in the case of the babul, so in those of this seed, no comparison as a rapid germinator could be found between it and any other fermented or non-fermented seed of this same species.

WEST BRIGHTON,
11th March, 1887.

R. F.

CLEARING FIRE LINES OF FOREST GROWTH.

IN reply to "Q." In the Central Provinces, where fire-protection has been carried on for many years with considerable success, combined with cheapness, it has been found that a good and effective fire-line should be 40 feet in breadth or more, and

should be entirely cleared of all trees and undergrowth; and, where feasible, grazing on this line should be prohibited. Soon after the rainy season, all fresh undergrowth of shrubs, &c., should be cut away, (if this work is promptly carried out each year immediately after the rains cease, the growth from the stools and stumps on the line will decrease and eventually die off,) and the grass on the reserve side cut for a breadth of some 12 to 15 feet according to length of grass, and the cut-grass thrown on the outer side of the cleared space, and in a week or more this grass is ready for burning,—and in a few weeks later on the standing grass on the line will also be dry enough to burn—and thus a complete fire-line will be obtained. The fact of having no trees on the line will save it from being constantly covered with leaves, and avoid the risk of fires thus crossing over; and having the undergrowth cut away early in the season makes the grass on the line dry up sooner than that in the forest on either side; and having a fringe of grass on the inner side cut and burnt first prevents any risk of fires entering the reserve when burning the line; and by having the grass on the line protected from grazing a perfectly cleared burnt line is obtained, which obviates the necessity of "burning over" several times which otherwise is required.

17th March, 1887. D.

GERMINATION OF BABUL SEEDS.

HAVING seen an article in the "Indian Forester" for April 1887, headed 'Germination of Babul Seeds,' I beg to say that, if it be purely for the sake of germinating of seed, that it should be necessary to pass through goats, it may be avoided, as it can be effected more efficaciously if the seed be steeped over-night in fresh cowdung, mixed with water of equal weight, and sown broadcast the next morning. This will have the desired effect, and is a procedure practised by the Bengalees in Lower Bengal, which I have seen, but never tried myself, not having the occasion.

J. C. SEDNEM.

II. Official Paper.

NOTE ON THE GOVERNMENT FORESTS OF BAHRAICH (OUDH) FROM THE POINT OF VIEW OF THE CHARACTER OF THE WORKING-PLANS DEMANDED FOR THEM.

By E. P. Dansey, Esq., *Assistant Inspector General of Forests, and formerly in charge of the Bahraich Forest Division.*

Classification of the Government Forests in Bahraich into four classes.—The Government forests in Bahraich (Oudh) can, for the purposes of the present Note, be divided into—

(A). Sissú and Khair Forest.
(B). Sál Pole Forest.
(C). High Sál Forest.
(D). Haldu and Dhao Forest.

2. *The Sissú and Khair Forests.*—To (A) belong—

(*a*). The North and South Burthapur Blocks,
(*b*). The Bardia Block,
(*c*). The Amba-Terhi Block,
(*d*). The Sujowlee Block,
(*e*). The Dharmapur Block,
(*f*). The Doba Block,
(*g*). The Babaya Block,

all in the Motipur Sub-Division, and aggregating an area of some 110 square miles = ⅓rd of the total extent of the Bahraich State forests.

The above tracts are, one and all, very unequally covered with forest, including, as they do, extensive grass lands that stretch away in every direction. Most of them have, in this way, a park-like appearance from the very irregular distribution of the trees, either in isolated fashion or in straggling clumps and groves. Thus the Doba Block can only by courtesy be described as a forest at all, seeing that it is merely a wide expanse of grass and tamarisk, with but a few khair trees standing at long intervals.

The only valuable species (in the present state of the market) found in these Blocks are khair and sissú. But whereas almost all the suitable khair trees have, by this time, been boiled down into catechu, the sound sissú have in the same way disappeared to meet the demands of the gun-carriage manufactories. Unsound or inferior trees alone remain to represent these two

useful species, since of their recent reproduction there is no important evidence anywhere.

Not one of these Blocks has been protected hitherto from either cattle or fires, and the open ground being generally covered with a dense and tall grass (subsequently burnt down by fires) or with a matted turf (where heavily grazed over) tree reproduction is only rendered possible along the water-courses, and in the more impenetrable groves.

Since there is no reason whatever why even fourth-rate forests like these should not become very valuable hereafter for the supply of fuel, let alone the requirements of the catechu trade, and the always considerable demand for sissú timber, our policy here should evidently be to close to cattle and fires, and to all present working, as large a tract as we can with due regard to the exigencies of the surrounding populations—exigencies that pertain mostly to their requirements in pasture land.

There would, in this way, appear to be no valid reason why we should not immediately close and strictly preserve—

(*a*). The North-Burthapur Block.

(*b*). The Sujowlee Block north of a line to be drawn due east from the river Gogra, and which would exclude a sufficient grazing-area to the south for all the villages in that direction.

There being absolutely no present demand for the species contained in the above Blocks, except in the case of such as have already been too exhaustively drawn upon, the Working-Plans for these forests would have to be prepared on exceedingly simple lines—providing merely for their continued protection and improvement, when possible, and for the re-stocking of blank areas, where desirable, with useful species, such as khair and sissú.

It would, of course, be necessary to exclude (by exchange, or otherwise) the village lands of Jamúnian and Dhakia in (*b*).

The border village of Kutes in Burthapur has ample waste lands of its own, besides which it is partly situated in Nepál, under conditions permitting of abundant grazing facilities in that territory.

3. *The Sál Pole Forests.*—Under (B) can be classed—

(*a*). The Churdah Forest.

(*b*). The Chakia Forest.

(*c*). The Motipur Sál Forest.

All three are mainly composed of sál, and that principally in the form of coppice-poles of varying age and dimensions.

4. *The Churdah Forest.*—The Churdah forest differs from the other two mentioned above in this that it is an almost unmixed sál forest, other species being very few and far between. It differs again in this that it is almost wholly constituted of young coppice-poles, young seedling trees not existing, and mature, or even large-sized trees of any kind being very scarce.

If we except certain tracts along the western and northern borders of this forest, and which are remarkable for the number, the well-shaped proportions, and vigorous vegetation of the poles there seen, the condition of the stock is unsatisfactory, although the ground itself is generally sufficiently well covered with trees. Almost every other stem is, in this case, crooked or mis-shapen, the result of former high-cutting and continuous pollarding. The soil itself is, here, exceedingly dry and poor, and for this reason Sir D. Brandis was always opposed to any immediate operations of improvement which could not be effected without uncovering the ground, and the more so that the dimensions of the poles are as yet generally small, both in height and in girth, and the difficulty of excluding cattle considerable.

Conditions have, however, much changed since Sir D. Brandis saw Churdah in 1881. A railroad now passes within an average distance of 10 miles from the heart of this forest, and a brisk demand has sprung up for poles of all sizes and qualities, as also for fuel and charcoal. The estate has, in fact, become a valuable property.

There can be no question that our policy is here to replace by healthy and straight coppice shoots the large percentage of inferior and crooked poles, without promise, that now encumber the ground, and take away from the value of the estate. The longer these are permitted to remain, the less prospect will there be of the roots continuing sufficiently healthy and vigorous for the subsequent formation of good standards. It is, therefore, not, altogether a question of expediency as regards the greater or lesser profits to be derived through permitting saleable poles to attain to still *more valuable* dimensions, so long always as the poles in question are of inferior quality. I maintain that, under the circumstances, it is better to sell for what we can, and replace such poles as soon as we can by material of the best quality obtainable.

In my opinion then we should remove every kind of unpromising growth, and that as rapidly as would be consistent with—

(*a*), the demand for such material (poles, fuel) as would be yielded by the operations;

(*b*), cultural considerations.

In the present case, the number of deformed stems to the unit of area is, as I have before remarked, very large. Consequently, if we concentrated our improvement operations, we should have everything to apprehend from the uncovering of the ground over large tracts, from excessive evaporation, and the still further deterioration of a soil already impoverished. My experience has been that where sál pole forest has thus been thinned out on dry poor soils, the resulting coppice has ever been a sickly one.

For these reasons, I recommend here the form of exploitation

known as "strip-fellings" or "line-fellings," and which is too well known for it to be necessary for me to enter into particulars. Practice alone can indicate what the width of the lines should be. This question depends, for each locality, on—

(*a*), the quality of the soil,
(*b*), the density of the stock,
(*c*), the height of the poles,
(*d*), the relative proportion of unpromising stems to the unit of area.

Generally speaking a width not exceeding 30 feet should suffice for this forest.

A considerable tract—five square miles or more—is closed to cattle, and we have there nothing to apprehend from their action. With regard to the remainder, there should be no difficulty in similarly closing one or more compartments at a time, and for short periods. Where reproduction is principally sought for from coppice shoots, as in the present instance, the presence of cattle in the localities worked over should not be injurious to any great extent, after a lapse of, say, two years.

The belts of original forest that should intervene between the lines of exploitation would have to be of at least three times the width of the latter.

The Working-Plan for the Chirdah forest would thus be of very simple construction, and, of course, by its nature, of a purely temporary character. The first operations should be of a preliminary type destined to test the local market, and to determine the quantity and form of material that could be disposed of remuneratively. Seeing that the exploitations are here most important for the purpose of improving the estate, it is evidently our policy to carry out these improvements as rapidly as we can, and we should, therefore, be most careful not to imperil the success of the operations at the very outset by looking too much upon them from a purely commercial point of view. We must here, if necessary, sacrifice immediately large returns in order to regenerate the forest within the shortest possible time. The essential is that the works should be self-supporting.

It is hardly necessary to observe that the exploitations should here include, besides sál poles of no promise, every description of inferior species, as also such mature sál trees—not of coppice-origin—as are occasionally met with. The latter are so few as to be but an unimportant factor in the present working of this forest.

It will be objected to here that if this forest were to be worked without any limit as to time, as suggested by me, or at least with only such limits as attach themselves to cultural considerations, and the nature of the demand, then it might possibly happen that the whole area, having been rapidly exploited of all bad growth, an interval would occur during which the revenue from this forest would be nil. To this I reply "What then? If this

forest was in a healthy normal condition, the revenue from it would be *nil now.*" Supposing that creepers fetched a good sale in the market, should I be less rapid in cutting them all down, even though they constituted the sole revenue of a forest too young to be exploited just yet?

5. *The Chakia Forest.*—The Chakia forest presents features that can be best described as coming between those of the Motipur sál forest and those of Churdah. It is not so uniform a forest as Churdah, not so vigorous or so old a forest as that of Motipur. Without being a pure sál forest like Churdah, it does not contain so large a proportion of inferior species as Nishangára. The ground is not so densely covered as in Churdah, but the vegetation is better, and there is more undergrowth. There is also more sál reproduction, and evidence of many of the recent sál stems having proceeded directly from seed. In Chakia, trees of different ages—from the mature old tree down to the seedling of a few years—go much more to constitute the stock than is the case even in Motipur, although the character of the forest is still that of a young one.

Like Motipur, the Chakia forest is very irregular in the distribution of the good sál localities. There are tracts without poles at all, and in which deteriorated old sál trees alone prevail. There are tracts again in which mohwa, ebony, asna and other inferior species occur to the more or less complete exclusion of sál. And again there are localities—witness almost the whole region east of the Mánd Nála—that have been ruined almost beyond recovery by excessive grazing and exhaustive fellings on the part of the neighbouring privileged inhabitants.

The number of sound mature trees—other than coppice-poles—of species having a present commercial value for their timber, is here again too small to constitute an important element in the provisions of the Working-Plan that is just now required. In the case of sál, they have been nearly all cut out.

As in Churdah, so here, our object, for some time to come, must be to improve the estate by the removal, as rapidly as circumstances will permit, of the very heavy relative proportion of crooked, diseased, mature, or otherwise unpromising sál poles, and by the extraction of inferior species generally, and mature sál trees other than coppice-poles, wherever this last form of improvement is rendered possible by the circumstances of the locality (that is to say, by the small relative proportion of inferior species to the more valuable kinds of trees, and by the condition of sál reproduction generally).

From a financial point of view the Chakia forest is even more favourably situated than that of Churdah, since, besides having the railway almost equally near, the Sarju river affords another convenient high-way for the removal of its produce. Already a very considerable local market exists in Chakia for all sorts of poles, as also for charcoal and fire-wood. The soil again is

generally much better than in Churdah, the trees taller, natural reproduction abundant in places: a considerable area is altogether closed to cattle. There is no reason, therefore, why operations of improvement, similar to those recommended for Churdah, and to be confined by the same considerations, should not be rapidly prosecuted in Chakia.

On the other hand, it must be observed that, in certain parts of Chakia, the condition of the forest is such as to justify our having recourse to concentrated fellings, as opposed to strip-fellings. But the Divisional officer on the ground could alone determine whether the one or the other method should be applied to a particular locality. Certain tracts as undoubtedly require confined operations, as other localities admit of more extended work.

But the outlines of a Working-Plan for Chakia would, in any case, be the same as for Churdah.

6. *The Motipur Sál Forest.*—The Motipur sál forest comprises the two separate Blocks of Nishangára and Murtiha, the former of which has been long closed to cattle and fires, and distinguishes itself from its neighbour—less fortunate in this respect—by the often magnificent undergrowth of sál seedlings which, with the aid of numerous poles of the same and other species, serves to make an almost impenetrable thicket wherever the soil is very rich in character, as it often here is.

The Murtiha Block, as I have observed, is not favoured to the same degree. Its soil is generally much less rich, and the forest has suffered from the greater proximity of cultivation, and from all the evils of easy accessibility. Although we, in Murtiha, have localities that are densely covered over with forest, the absence of recent sál reproduction is yet everywhere conspicuous, and most of the area is either very insufficiently stocked, or is absolutely ruined as a sál-producing tract: (See the extensive belt of bael and khair forest to the west of the Block).

The Motipur sál forest distinguishes itself from Chakia by its more vigorous vegetation, and the much larger size of trees of the same age, and from both Chakia and Churdah by the greater relative proportion in the stock of other species than sál. Mature trees—not of coppice origin—occur here in greater numbers, and there is evidence in this as in the presence of occasional healthy middle-sized trees, that a more considerable portion of the stock has proceeded directly from seed. But although the number of sál trees of superior dimensions, or that have attained to the limits of maturity, is large, these are very generally unsound, and the importance of this element in the stock is never such as to make it desirable for us to shape a present Working-Plan in accordance therewith.

The conspicuous features of the whole Motipur sál forest are that, over considerable tracts—wherever, in fact, the soil is rich—

(*a*), the stock is often too dense, too crowded;

(*b*), the relative proportion of inferior species of little or no value is very considerable;

(*c*), the proportion of crooked, diseased, and over-mature sál coppice-poles is excessive.

Again, where the trees are not themselves too numerously represented, these same rich tracts are remarkable—in Nishangára at least—for a very luxuriant undergrowth of sál seedlings, several feet in height,—a circumstance which then permits of our removing, if necessary, the entire standing stock of unpromising poles and mature trees without injury to the forest.

The above description of the Motipur sál forest indicates also the provisions which would be generally made to apply in a Working-Plan for it—a Working-Plan based on the *present abnormal constitution of the forest*, and which would be quite sufficient for all present purposes.* There is a fair market—at cheap prices—for all sizes of sál and asna poles, and there is some prospect of securing a permanent and considerable outlet for both timber and fire-wood in the direction of Byramghát and Lucknow.

Subject to these conditions as regards the possibility of disposing of the material, a Working-Plan for the Motipur sál

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* Supposing that Lucknow consumes as much as 400,000 maunds of dry fire-wood per annum from this forest, there would certainly be quite 20 years of progressive work on that scale, in the Nishangára Block alone; and, after that time, it is surely not too much for me to hope that the Murtiha Block will have so far improved as to admit of the same work being carried on there for, say, 10 years. And, by that time, if not long before, the Nishangára Block will want further thinnings.

With regard to all three sál forests of Motipur, Churdah, and Chakia, the fact must not be lost sight of that the stock is essentially young, and that these forests are only workable, therefore, by reason of such extraordinary requirements as those alluded to. I have assumed the correct principle in all such cases—where the State is proprietor, and not dependent on the revenues from these three forests—to be that already previously enunciated by me, *viz.*, to only limit the extent of these very necessary works of improvement by the facility or otherwise of disposing of the produce profitably and by the exigencies of the stock. Under existing conditions it is very improbable that, in either of these forests, we should come to the end of our resources (as measured by sickly and unpromising growth) before at least 10 years—in Motipur not before 20 or 30 years. And supposing that we did exhaust the yield of this sort of material within a briefer period, what then? In a healthy condition, these forests should, *normally*, be able to supply no more than they undoubtedly will still continue to supply when the present Plans, based on their improvement alone, shall have died a natural death on the completion of the great work which should now give birth to them.

Assuming that the Plans in question should prescribe time and should prescribe definite areas to be gone over each year, the uncertainty of the demand, more especially in Motipur, would make such a prescription futile except as a maximum limit beyond which operations should never be conducted. And such maximum limit itself would be extremely difficult to impose, seeing that the material yielded in the contemplated works of improvement must vary exceedingly over different parts of the forest, and this is particularly the case in Motipur, rendering it most difficult to apportion the area to the several years of the rotation.

Captain Wood was not wholly wrong when he wrote saying that the time had not yet come for Working-Plans in Bahraich, by which he evidently intended to convey that in the present youthful and abnormal condition of these forests, a very simple outline of policy was alone called for during the present generation.

forests would have to be constructed on the same simple outlines as have already been suggested for Churdah and Chakia. But the system of strip-fellings would be here quite unnecessary; and, owing to the fine undergrowth of sál seedlings that prevails over extensive areas in Nishangára, very heavy fellings in one locality would there be not only practicable, but, occasionally, even advisable.

It must not be lost sight of that this undergrowth of sál has suffered from suppression, and that it will, hence, be generally expedient to cut it flush with the ground after exploitation—the more so that the exploitations themselves will result in severely mutilating most of the young stems comprised in it. The operation suggested would have this beneficial result that a coppice of uniform height and vigour, and possessing moreover all the attributes of young seedlings, would, within a couple of years, take the place of the sickly and diseased crop thus removed.

The advisability of constructing a tramway between this forest and the mart of Sujowlee on the Gogra river, has been often urged. Supposing that the systematic working of this forest is to mainly depend for some time to come on the demand for fuel in Lucknow, and on a departmental system of operations, we can well appreciate the necessity for this means of transport. Present circumstances seem to point that way. But we should not be in too great a hurry, nevertheless. It will be as well first to gauge the requirements of this new market, before committing ourselves to so large an immediate outlay.

7. *The High Sál Forests of Bahraich.*—To (C) belong the Bhinga forest, and the E Gubbapur Block of the Sohelwa forest.

8. *The Bhinga Forest.*—The Bhinga forest is, by no means, a pure sál forest. It is largely mixed with ebony, tikwee, bahera, mohwa, asna, kusum, and other species. And the sál occurs mostly in the form of hollow old trees. This forest is everywhere sufficiently open to admit of sál reproduction; and, in the greater number of cases, it is too open, degenerating off the villages into park-like tracts, in which clumps of trees alternate with grassy glades or with wide expanses covered with impenetrable thorn. Nowhere do we meet with successful sál reproduction. Poles of the species are extremely rare, and then never young, while the soil has become hard and dense, and manifestly unsuitable to sál. The whole forest is apparently in a state of transition from a sál to a miscellaneous stock.

Nevertheless, we should not, under present circumstances, despair of the future of the Bhinga reserve in its capacity of a sál-producing tract. It must be borne in mind that this forest has been subjected to exaggerated ill-usage, for many generations past. We should not be justified, therefore, in treating this forest as one in which sál had no future, before this circumstance had been practically ascertained beyond any reasonable doubt. In the very small areas that have, for some ten years,

been more or less successfully closed to cattle and fires, a manifest improvement has already taken place, both in the soil and in the condition of the forest generally; and we should not, in the present stage of our knowledge, despair of ultimately restoring this very ancient sál forest, although it will, of course, take many scores of years to effect this desirable end.

Since the forest has, everyhere, been already quite sufficiently thinned, pending the appearance of an undergrowth of sál, a Working-Plan for the Bhinga reserve would aim mainly at procuring for it—say for the next fifteen years—as large a share of repose, of the most absolute kind, as was compatible with the acknowledged rights and requirements of the surrounding populations. Exploitations would, during that time, have to be confined to dead and dying trees.

From the operation of the Plan should, however, be excluded all such tracts (lying off the villages) as it will evidently be necessary for us to permanently surrender for purposes of grazing and village-supply—tracts, for the most part, already deteriorated beyond repair. It would be a useless and wasteful extravagance on our part to leave unfelled, under these special circumstances, any valuable timber, already mature, so long as we suffered to remain as many trees as were necessary to maintain such forest in its condition of pasture land. For this purpose there will generally always be found on the ground a sufficient number of inferior species and shrubs of sorts, without it being necessary for us, in view of a reproduction of sál that will surely never come, to abandon saleable mature trees of that species. Hollow old sál trees are eagerly bought up in Bhinga, and either made into canoes, or split up into rafters, props, posts, and ridge-poles (all for house-construction), or into cattle-troughs, and a number of other useful commodities. Since nearly every mature sál tree found growing, under these conditions, is already hollow, their removal should, evidently, only be regulated by the facility or otherwise of disposing of the material to a profit.

The great difficulty, in Bhinga, will be to deal with the "privileged" villagers and their requirements, and this in such a way as to secure the absolute repose I have referred to for the largest possible area of forest.

It need hardly be observed that the problem of re-stocking the Bhinga forest artificially, and at a recuperative outlay, should never be lost sight of, and that experiments should be from time to time had recourse to with this object in view.

9. *The Gubbapur Block.*—The Gubbapur Block of the Sohelwa forest is the only sál forest in Bahraich which at all approaches to the irregular character of a normal forest of that species—that is to say, a forest in which trees of all ages occur associated together in natural fashion. But it is, by no means, a pure sál forest. While sál is here always found in company

with a large proportion of inferior species (principally dhao, tikwee and asna) there are tracts occupied by tikwee and dhao, or by these and other species combined, to the total, or almost total, exclusion of sál. Off cultivation again, expanses of deteriorated forest occur in which thorns prevail along with unsound old sál trees at intervals. In other respects, the character of the forest is a healthy one, and the vigour and abundance of the young growth of sál is then often a striking feature of the locality.

While the lower portions of the Block have been, as a general rule, already exhausted of their stock of mature sound sál trees, there is much of the hilly zone above that has altogether escaped, and, in this way, there may be said to be still much sál timber of good dimensions and quality in this forest, that is immediately available, let alone asna trees of superb dimensions.

What we have to do in Gubbapur is to arrange for the gradual exploitation of the present stock of mature sál trees, and that during a period which will be sufficiently long to enable an equal number—after allowances have been made for the abnormally great age to which some of the present stock of mature trees have been allowed to grow—of the younger trees to reach the dimensions recognized to be the most useful for the requirements of the State in this direction, and which are probably here represented by a diameter of 2 feet. Owing to the very unequal distribution of the sál trees in this Block, a complete enumeration survey of the 1st and 2nd class trees would have in any case to be made. Since, however, in practice it is impossible to conduct a complete enumeration survey *accurately* over a forest without taking stock of all, or nearly all, the trees of the same species, it would be preferable to include in the survey every sál tree exceeding 6 inches in diameter, and these would, of course, be divided into a larger or lesser number of classes, according to the accuracy required. In the present instance, the following classification should suffice—

I.	1st class trees,	...	...	2′ diameter and above.	
II.	„	„	...	...	1½′ — 2′ diameter.
III.	„	„	...	...	1′ — 1½′ „
IV.	„	„	...	...	6″ — 1′ „

The survey had here better be executed Compartment by Compartment and be supplemented by an accurate description of each. The Compartments should be defined, as regards situation and extent, by roads and water-courses, and no attempt should be made to constitute them on any other basis. Only such tracts should be included in the survey as came within the specially protected zone—that preserved from fires and cattle—or which, it was premised, would, later on, come within the influence of protection. Such areas as must *necessarily* be left open to cattle, had better be treated in the way suggested for a similar condition of things in Bhinga.

It would be necessary to distinguish, in the survey between the sound and the unsound sál, and the Working-Plan would provide for the progress of the exploitations, over such parts only as were ripe (by reason of an abundant undergrowth of young sál, or the number of existing trees of that species) for the purpose.

Owing to difficulties of ground, the extraction of *logs* would, in a few localities, be found impossible.

In the present state of the market, as regards asna, dhao, and tikwee, it is manifestly unnecessary to include them, or the other prevailing inferior species—except in a general way—in the provisions of the Working-Plan, unnecessary, therefore, to take stock of them. The principle followed in reference to all species other than sál should always be, in sál forest, to cut out the former to any extent compatible with their profitable disposal, and immediate replacement by sál of good promise, and that, of course, most generally, without recourse being necessary to artificial means of propagation.

The soil, in Gubbapur, is almost everywhere suitable for sál, and it is suggested that the latter might be rendered much more abundant than it is by a judicious distribution (by the process of dibbling, for instance) of seed over the surface of the protected areas. There are here large tracts, now containing nothing but tikwee and asna, which could be transformed in this way, it is urged, into valuable sál forest. It must be borne in mind that the sál seed is not shed to more than 100 feet or so from the parent tree, and that this circumstance is much against a rapid spread of the species over lands from which it has been once ousted, or which it has not yet invaded.

10. *The Sonpathri Block.*—Under (D) I have only that portion of the Sohelwa forest to mention, which is known as the "Sonpathri" Block.

Although merely a continuation of Gubbapur in an easterly direction, the character of the forest is no longer the same, or is similar only to isolated localities in that Block. Its distinguishing feature is that, if we except a few unsound old sál trees that we find distributed at very rare intervals through the forest, and groups of sál poles of mean appearance occurring in insignificant numbers along a few of the water-courses (mostly towards the base of the hills) the whole tract is destitute of this valuable species, those prevailing being principally tikwee and dhao, associated with burgat, dháman (Grewia), pipal, jaman, siris, kusum, khair, bael, rohni, &c., &c. Much of this Block (east of the Sonpathri Kula) is in a semi-ruined condition from over-grazing, over-felling, and annual fires, and the whole of the Block has, in a greater or a lesser degree, degenerated into a thorn scrub for a considerable distance off cultivation. Not until 1885 did we succeed in placing any portion of the Sonpathri under special protection as regards

grazing and fires, and then only about one-fourth of the total area.

What we have to determine in this Block is whether, with a judicious selection of the more suitable localities for the purpose, we could not, by means of dibbling or other artificial processes, again succeed in extending the areas covered by sál, as suggested by me in the case of the previous Block.

My own opinion is that this is perfectly feasible, and that the improvement could be effected with very little comparative outlay, seeing that the soil is generally such as sál can reproduce itself in, its main defect being an excessive dryness. It will, however, be borne in mind that I nowhere advocate these works for localities in which this dryness of the soil is so conspicuous as to be characterized by peculiar conditions of vegetation, such as pure dhao, khair or bael forest, that I only propose having recourse to these works in the better parts of the Block, and particularly so in those parts which have been recently closed.

The working of the Sonpathri Block has—if we except the considerable quantity of material supplied annually to the neighbouring villages—hitherto been confined by us to the removal, by purchasers, of dead wood (for firewood and charcoal), and to their extraction of a certain quantity of catechu. There is absolutely no present demand for the kinds of timber found in this forest other than that centred in the requirements of the immediate locality, and these we are compelled to meet without a payment in return.

A Working-Plan for the Sonpathri Block would, therefore, merely arrange, for a term of years, for such improvements as I have already suggested, and indicate the localities, and the circumstances under which, the present demand, if any, should be supplied from.

Supposing that the conversion of this forest into a sál forest, over large tracts, were shown to be possible, and at a small comparative outlay, the Working-Plan would lay down the area to be thus annually converted, and the exploitation of all other species would then—after a time at least—have to be regulated by the requirements of the case, and by the area to be in this way regenerated each year.

11. *Conclusion.*—Generally speaking, the whole of the Bahraich forests have been much overworked in the vicinity of cultivation. There is thus much danger that the villagers, in the absence of reproduction on the tracts thus ravaged by their fellings, by their fires, and by their cattle, will, before long, insist that the portions of forest under improvement by us may be similarly opened out to them, and for similar purposes of ruin and waste.

The Working-Plan for the Bahraich State forests will, therefore, necessarily, make the best arrangements possible whereby the last mentioned alternative shall either be entirely obviated, or

at least, be only permitted in cases where the condition of the forest (as in Nishangára) is such as admits of much thinning and weeding out of young trees. Seeing what a deteriorated condition all the State forests of Bahraich are in already, this becomes a very difficult question. In Bhinga there would appear to be absolutely no compromise possible. The whole forest is in such a condition that Government has only three courses before it :—

(*a*), to open presently the closed tracts to the villagers, and submit to the gradual ruin of the entire reserve ;

(*b*), to say that the present closed tracts shall not be so opened under any circumstance, and submit to the devastation of the rest ;

(*c*), to abolish the privileges altogether—at least in their present shape—as being incompatible with the life of the forest, and the undoubted interests possessed in the latter by the population of the district generally.

Evidently, the pasture of cattle would have, in the same way, to be regulated in harmony with the requirements of each Block or forest for which a separate Working-Plan had to be made.

The preparation of Working-Plans for the Bahraich Government forests would thus not be a work of much labour, they being necessarily very temporary in character, and simple in outline. All of them could conveniently be entered in a single report of the size of an Oudh Annual Progress Report, and one officer (not the divisional officer) should be able to prepare the whole of them within a single Working-Season.

In the sál forests alone would I recommend any division into Compartments, and then I would have the area of each Compartment as large as was advisable for motives of easy description, working, and control. In the present case, 3 square miles will not be found too large for the purpose, the stock being often very homogeneous in character over large tracts, as in Nishangára and Bhinga, where 5 square miles of forest and more could, with sufficient accuracy, be described as uniform in type throughout.

The Revenue Survey Maps of Bahraich are quite correct enough, and quite large enough, for the purposes of present Working-Plans in that district.

NOTES, QUERIES AND EXTRACTS.

THE MADRAS FORESTS.—A correspondent writes to us :—Your paragraph on the forest question in Madras, has a mournful interest. One could hardly have believed that Government could have thrown open its best reserves in Tinnevelly to practically indiscriminate cattle-grazing. Yet on the best authority I learn that this was done last year. The not unnatural result was a bad fire in a reserve that had been protected for years, and thousands of rupees damage to timber and forest products. The damage to the country generally and to the ryots is incalculable. The Madras Government seems incapable of properly appreciating the forest question. The late Governor, it is true, took an interest in it, and with the help of Dr. Brandis, the Forest Act was passed, two decades too late. But, in the administration of the Act, the present Governor is, I fear, as retrograde as ever, and listens to the short-sighted complaints of those who objected to conservancy on the ground that it is inimical to the production of cattle. The most ridiculous complaints are constantly published in the Madras papers. One man dilates on the importance of cattle to the country, and then deplores the exclusion of cattle from certain forests, forgetting that for many years all the forests have been given up to the grazier. The agriculturists do not send to the forests their well-bred useful cattle that plough and irrigate and draw carts. It is only the poor useless beasts worth no more than their hide, and the cows and immature animals, that are sent there. During their stay in the jungles the immature heifers are covered by worthless sires, and the worst features of Indian cattle breeding perpetuated. Fires are lighted intentionally to secure the crop of green grass after the first shower; or sometimes, accidentally through carelessness, and each year the forest loses several year's growth, and the doom of sterility is made surer and surer for the south of the peninsula. The grazier first destroyed all the more accessible jungles. Now he would lay his hands on the poor remains, saved so long by their inaccessibility, and which are now, the so-called reserves. One of those who have lately aired their grievances in the Madras papers naïvely exposes the real nature of their claims. He speaks of "those who live on the outskirts of Government forests, and are unfortunate enough to own cattle. It is plain enough that the peasants whose villages adjoin the forests have become cattle dealers, their stock being reared solely on their neighbours' woodland. It is natural enough that

they should be displeased at their usurpation being put a stop to, but their complaint should be regarded not as the legitimate complaint of a poor man deprived of an undoubted and reasonable right, but as the howl of disappointed avarice; disappointed in the hope of making a profit at the expense of the general public. In 1882, the business of conservancy seemed really to have started in Madras, but last year, all progress seems to have been stopped, and the measures of Government are now actually retrograde. As I write, I can see on a neighbouring hill-side a beautiful line of fire which marks where the jungle is burning merrily. Very likely this is one of the Forest Department's reserved forests. If unburnt, it might have yielded valuable products and provided bountiful pasture for cattle in the next famine. Now that it is burnt, it will keep alive a few worthless beasts, rear a few ill-bred calves and plenty of goats, and put a few rupees into some cattle dealer's hands, but not benefit the cultivator or the labourer. The country has lost so many hundred acres of timber, so much more soil will be swept down in the next rains. Some stream will have a little less water in the hot season, and in the rains will be a worse torrent than before;—perhaps the extra rush of water exceeding the utmost that some engineer has calculated on, will burst some tank, or wash away a bridge;—and all because Government will not accept the teaching of science, and lends a ready ear to the outcry of the ignorant. Not only is the protection of the reserves neglected, but I understand that it is contemplated to reserve no more, though the forests are far short of the requirements of the country. In some cases, lands are being thrown open, not because they are unfit for forests, but because they may be wanted for increase of cultivation—a reason which is not justified by facts. A small extension in the area of badly cultivated lands is no great benefit to the community, but a bit of natural forest which is worth reserving, is a possession of great value, which when once destroyed it is almost impossible to replace.—*Indian Agriculturist.*

GAME PRESERVATION AND FOREST LAWS.—I have read with much interest the various letters which have appeared in your columns on the above subject, and with your permission would like to make a few remarks thereon.

"Gamekeeper's" statement that deer are slaughtered on a large scale during the rains is no doubt perfectly true, and he would be doing us all a great service by informing me which are the exact localities where these practices are carried on. I now invite him publicly to write to me, or, if he is a Dehra man, to let me know verbally where he saw the chapars or shanties and all the signs of a hunter's abode; and I will undertake to have that locality carefully watched next rains, and will do my

utmost to bag the whole gang of poachers. I do not expect very much in this way from forest guards, but I do hope and trust that all sportsmen in the Dún will assist the Forest officer, as far as lies in their power, by informing him whenever they see the shooting rules broken. In my opinion this will be far more to the purpose than writing to the papers months afterwards, though I, for one, am very glad to see the matter discussed in your columns.

There are about 400 gun licenses issued annually by the Superintendent of the Dun to zemindars and others; add to this the "Company" guns of the two Gúrkha battalions, and the unlicensed guns alluded to by "Gamekeeper," and you have a formidable array of arms pretty steadily at work, quite sufficient to account for the disappearance of game. It is not always the holder of the license who shoots. Two cases have recently come under my personal notice. In one case the sportsman with a sambhar stag on his shoulders was a Gúrkha pensioner—the holder of the gun license, a havildar in the regiment; in the other case the would-be sportsman was a Gúrkha line boy, but he was "headed," and politely requested to return to Dehra. All these cases are punishable under the Arms Act.

But the remedy lies partly with the Superintendent of the Dun—let him issue only one-half the number of licenses, and cut the gun barrels down to a length of two feet—and partly with the higher Forest authorities, or the proposed Committee on the shooting rules; let them decree that there shall be no shooting whatever in the Government forests except on payment of a certain fee, and obtaining a non-transferable license. Carry out these two proposals and much will have been done to increase and preserve the game in the Dún. Then, if tigers and other "dangerous and destructive animals" increase and multiply to such an extent that "H. L." will have to pay an enhanced rate for his beef (*vide* his last letter to the "Asian"), a raid can easily be made on them by the license-holders at any time of the year. Even as matters stand at present, if village cattle are being carried off in any particular locality, special leave can be given for the destruction of the marauder.

With regard to fishing with small mesh nets, is "Gamekeeper" aware that the rules at present apply only to such portions of the streams as run through Government forests? Fishing with nets is at present unfortunately quite legal in zemindari waters (nearly the whole of the Asan and Tons, the upper waters of the Song and Suswa); and what can be expected from the native when a large European zemindar sells the right to net the river running through his estate; when another European resident of Dehra, learned in the law, furnishes a man with a cast net and a pass saying "This is my fisherman;" and our neighbour the Raja of Nahan allows netting in the lower part of the Giri river? What we want here is a Dehra

Dún Fishing Association and a strongly-supported application to the powers that be to pass a stringent law on the subject. The local Legislative Council might turn their attention to this question. On this matter the letter of the Honorary Secretary, North Punjab Fishing Club, reported in the April number of the "Indian Forester" from the "Civil and Military Gazette," is worth perusal. Now if "Gamekeeper," "Deerstalker" and "H. L." will only put their heads together, and call a public meeting, inviting the attendance of all true sportsmen, I feel convinced that good will result, and wholesale destruction of game and fish in the Dún become a thing of the past.—A. SMYTHIES.

DEHRA DUN, *Easter Monday.* —*Asian.*

CLOSING GOVERNMENT FORESTS.—In the rules regarding shooting in the Dehra Dún Government forests, lately published in your paper, there are two provisions which require modifying—

1st.—The closing of the forests from the 1st February.

2nd.—The re-opening of them on the 16th July.

The 1st February is too early for closing the forests; not only is February the pleasantest month in camp, but large cheetul horns are seldom obtained perfect before this month (in this part of the world at least); so that cheetul shooting is practically forbidden altogether, as they must be shot with their horns in velvet, or not at all. Then why should such an early date be fixed? I believe that Europeans might be allowed to shoot at all seasons without any fear of their setting fire to the grass; but certainly during the whole of February the grass is too green to burn; and as, from a sportsman's point of view, there is no objection to shooting stags in that month, it appears a useless piece of tyranny closing the forests before the 1st March.

As to the second point, no Europeans care to shoot in the Dún between the 16th July and the 1st October; why then declare the forests open during that period solely for the benefit of native poachers? I trust you will assist us by advocating the keeping the forests open from 1st October to 1st March only.—DEERSTALKER.—*Asian.*

THE paper on Swiss Forest Management, which appeared in the April Number, is by Mr. G. Cadell, formerly of the Madras Forest Department, and now residing at Lausanne.

BY ORDER OF THE LIEUTENANT GOVERNOR

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A FOREST TOUR IN PROVENCE AND THE CEVENNES.* *By* Major F. Bailey, R.E.

On the 22nd April, 1885, a party, consisting of MM. Puton and Boppe, the Director and Deputy-Director of the Forest School, Mr. Elliott, of the Punjab Forest Department, nine English students, Mr. Takasima, a Japanese gentleman studying at the school, and the writer of these pages, left Nancy for Marseilles. After we had passed Dijon, and before darkness set in, the line led us along the foot of the Côte d'Or hills, which are famous for the wine they produce; and when morning dawned we found ourselves near the mouths of the Rhone, crossing the desolate Plaine de la Cran, which consists entirely of pebbles and gravel, and is probably of glacial origin. It is quite uncultivated, and is likely to remain so until the works now in progress for leading the turbid water of the Durance to deposit their silt upon it are somewhat more advanced, and until a fringe of forest can be raised on the northern side, as a protection against the terrible *mistral* wind which blows from that direction. The sudden change of $5\frac{1}{2}°$ of latitude we had passed through, made itself evident by the advanced condition of the vegetation. At Nancy the leaf-buds were only bursting, whereas at Marseilles the trees on the numerous boulevards and in the beautiful public gardens were in full foliage. Here we observed a number of palms in flower, and a small species of bamboo, not unlike the Himalayan *ringal* (*Arundinaria falcata*); while near our hotel was a fine row of Australian gum trees (*Eucalyptus globulus*), 6 feet in girth, and said to be seventeen years old. It is not possible to leave Marseilles without remarking on the magnificent mules which one sees everywhere in the streets, some of them being probably 17 hands high. These animals, laden with a most unnecessary amount of cumbrous harness, are put into the waggon-shafts,

* From the Transactions of the Botanical Society of Edinburgh, Vol. XVI, Part III. (Read May 13th, 1886).

preceded by a string of three or four horses and ponies of gradually diminishing size, and the team is finished off with a very small pony, or sometimes a donkey! We also saw a number of active, wiry little Algerian ponies running in light carts, and reminding us of a good class of northern Indian country-breds.

The Forest of La Sainte Baume.—The railway from Marseilles to Aubagne passes through a very pretty bit of country. On the high ground the Aleppo pine (*P. halepensis*) grows in fair abundance, the white limestone rock appearing through its dark foliage. At the foot of the hills, in the fertile valley through which the line follows the stream, numerous chateaux and villas were seen, some of them standing in beautifully kept grounds, containing trees and shrubs of many kinds, most of which were in spring leaf, the horse-chestnut and black-thorn being in flower, whilst fresh green meadows, studded with white narcissus and other flowers, flanked the railway. On leaving Aubagne we travelled on a branch line to Auriol, near which place the country became more wild, and the number of vine terraces increased; but it was sad to note the desolation wrought in recent years by the *Phylloxera*, the terraces, which in prosperous days were built at an enormous cost, now showing only the stump of a vine here and there, other crops being raised upon them. It is said that it will be necessary to wait three years before replanting the ground, and grafting an American species of vine; this will not involve a very heavy outlay, but in the meantime the loss of the grape crop is most severely felt. On arriving at Auriol we were received by a forest guard, who had brought two carriages to convey us to the village of St. Zacharias, where we were met by MM. Delaporte and Rogé, the local Inspector and Sub-Inspector; and accompanied by them we started on a walk of eight miles to the Hospice of St. Baume, where we were to pass the night. The Provencal region, in which we now were, differs widely from that which we had left at Nancy. During half the year rain very rarely falls, and the country then becomes excessively hot—"as hot as India," as a friend of the writer, who passes the winters at Hyères, and has been in Hindustan, once said to him. The nature of the forest vegetation is completely changed by this distribution of the rainfall, the number of species being much smaller than it is in more favoured localities. Here is found the Aleppo pine, which characterises the hot districts bordering the Mediterranean, the broad-leaved kinds being chiefly those with persistent leaves, such as the wild olive and the evergreen oak (*Q. Ilex*). The trees do not attain such large dimensions as those in the north, but they are of sufficient girth to yield useful timber, and they grow wherever they can find a little soil in which to establish themselves. The shrubs are for the most part evergreen, and bushy in form, one of the principal kinds being the dwarf oak (*Q. coccifera*), which, growing to a height of about 3 feet, fairly

covers the ground in places; it is associated with several species of juniper and other shrubs. The herbaceous plants are chiefly those which characterise limestone soil in hot regions, most of them having rigid leaves and highly scented flowers; such, for example, as the lavender, the rosemary, and thyme. An undergrowth thus constituted protects the soil, which, however, is not of a nature very liable to erosion, whilst it acts to some extent in arresting the progress of forest fires, which cannot spread rapidly through it. In the part of the hills we were passing through, the limestone rock was visible everywhere, there being hardly any soil upon it—none at all, indeed, in many places; but in spite of this, and of the ill-usage the forest, which is private property, is subjected to, there is a light crop of pine and oak growing spontaneously; the latter being treated as a simple coppice, cut for fuel every five years. Sheep are admitted, but not in large numbers, and it is probable that the harm they do is small, in comparison with that caused by overcutting, there being little doubt that, if this were restricted, a fine forest could be raised in spite of the limited grazing that is practised. There were a great many caterpillars on the pines, which seemed to suffer a good deal in consequence. As we rose higher up the valley, the hills became more bare of trees, and their appearance, furrowed by dry water-courses, marked by numerous small landslips, and scored over by a network of sheep-tracks, forcibly reminded those of us who had been in the Punjab, of some parts of that province. As we mounted still higher the slopes became even more barren, and it was easy to imagine how soon a multitude of goats, such as would be found in a similar locality in India, would cause the complete disappearance of the last vestiges of forest growth. After walking for some time through this uninviting tract, we gained a plateau, bounded towards the sea by high rocks, on the soil washed down from which some fields have been established; and at the further end of this plateau is situated the hospice where we were to pass the night.

The hospice of La Sainte Baume (Holy Grotto) is maintained by the Dominican Monks for the accommodation and feeding of the pilgrims who visit the shrine annually during the summer months, to the number of thirty or forty thousand. The sacred grotto is high up in the rocks above, and is said to have been the refuge of Mary Magdalene after the Crucifixion. Notwithstanding that the day was Friday, we were provided with an excellent breakfast, after which we proceeded to inspect the forest, which formed for us, of course, the great attraction of the place. It covers an area of 340 acres, at the foot of the rocks, immediately below the grotto, and has been preserved by the monks as sacred from very early times. Except to satisfy their very limited requirements, it remained untouched until the Revolution of 1790, when it was appropriated by the State.

Some trees were then cut, but very few, on account of the absence of export roads, and to this day it is almost a virgin forest, only dead or dying trees being taken out. On entering it, one is immediately struck by its extraordinary character. Here, in the hot, dry region of Provence, we could imagine ourselves suddenly transported back to Nancy. There are huge beech trees, with oak (*Q. sessiliflora*), maple, lime, hornbeam, and other kinds that are not found anywhere else in this part of the country, certainly not within a distance of nearly seventy miles as the crow flies. There are many yew trees, some of huge size and apparently of great age, and also a large number of hollies. The ground, which is, generally speaking, covered with a deep layer of vegetable mould, was, where the forest was at all open, carpeted with flowers, many of the kinds found at Nancy, the sweet-scented violet and narcissus being very plentiful. *Daphne oleoides*, so common in parts of the Himalaya, was also very abundant, and the whole tract was alive with nightingales and thrushes. The mean altitude is about 2,500 feet above sea-level, and the annual rainfall is 36 inches, spread over six months of the year. The presence of the forest here is accounted for by the theory that the currents of air from the sea on the one side, and from the Alps on the other, meet on the rocky ridge which runs parallel to the coast-line, and discharge their moisture on it; but it seems at least probable that their influence is aided by springs, which rise at the foot of the cliffs in sufficient quantity to keep the soil always moist. However this may be, there the forest lies, surrounded on all sides by barren desolation, and in it are some of as fine trees as one could wish to see. A remarkable fact in connection with them is that their wood is extraordinarily heavy, generally speaking, one-third more so than that of the same species grown at Nancy; this being probably due to the increased light and heat which they receive as compared with those which are found in more northerly latitudes, as well as to the moisture pervading the air and soil. Some of the hornbeam is so heavy that it will not float in water. There are signs of ancient cultivation within the forest—yew trees, apparently centuries old, now standing on the old terraces.

As we neared the foot of the cliff, the trees became stunted, and finally they ceased altogether; but we followed a path leading to the summit, where we obtained a view over the dried-up desolate country surrounding us on every side, and we were then able fully to realise the remarkable position that this little oasis occupies. On our way down we paid a visit to the holy grotto, which contains a beautiful spring of water as well as many altars and statues, and while we were there the friar, who lives at its entrance, returned; he is a botanist, and had his wallet full of specimens he had collected on his way up the hill. After some conversation with him, we descended through the

forest by another road to the hospice, where the amiable and cheerful monk who has charge of it met us, and after dinner we sought our rooms, and slept soundly on our straw mattresses.

Next morning we shouldered our knapsacks and started to walk across the hills to Aubagne, in order to take the train to Toulon. The first thing that struck us, was that the moment the limits of the State forest were passed, we had left behind us all trace of the remarkable vegetation we had observed the day before. This may no doubt be partly accounted for by protection being less rigid in the private forest we were entering; but it seemed also probable that the natural conditions had changed, the soil being no longer moistened by springs issuing from under the cliffs. We were now in a forest of Scots pine, subjected to uncontrolled though moderate selection fellings, which, notwithstanding the entrance of sheep, permit the maintenance of a fair crop of trees of small size, the larger ones being capable of yielding useful planks. The population is scanty, fires being unknown, and there are very few goats, which it is said do not thrive here. There was a fair undergrowth of young pine mixed with juniper, and wherever the cover was light the ground was carpeted with green herbs. Further on some oaks appeared, one fine old tree 20 feet in girth remaining to testify that they were indeed "giants in the earth" in former days. This forest stretches up to the foot of the high perpendicular limestone cliffs, above which there is a communal forest, managed on the selection method, and said to contain somewhat better trees than those we saw, but unfortunately we were unable to visit it. Before crossing a ridge we came upon an abandoned mine, with a coal seam 8 inches thick, which it does not pay to work. The descent was a very abrupt one, through a simple coppice of evergreen oak, cut at the age of twenty years; but the ground was very rocky, and the crop thin. Lower down we saw isolated Aleppo pines standing among the oak coppice, and there was a good deal of the dwarf oak, the evergreen leaves of which exercise an important influence in opposing the spread of forest fires. The wild, rocky aspect of the hills, and the general appearance of the vegetation, reminded some of us very much of parts of India; but as we approached the stream at the bottom of the valley all this changed, and we were able to note the great difference produced in the growth of the trees by the moister soil. Here were pines of large size, mixed with elm, poplar, chestnut and plane (*Acer platanoides*); while the laburnum and Judas tree (*Cercis*) were in full bloom, and the grass green and bright, the contrast to the scene we had left being very agreeable. Presently the valley opened out, and further on we passed a saw-mill worked by water power, in which planks for packing cases were being cut up, and the road then led through a number of orchards and meadows. On reaching Aubagne we took the train to Toulon,

the railway passing along the coast, and affording some fine views of the sea. Here again the vines are nearly all destroyed, and cereals are grown on the terraces which were constructed for them; but we saw great numbers of olive trees and many fields of "everlastings," which are exported for making funeral wreaths. We were met at the station and conducted to our hotel by M. Madon, the Forest officer in charge of the Maures, to whose kindness and courtesy we subsequently owed so much.

On the following morning we were to have inspected the celebrated Mont Faron, but heavy rain fell all day, a most unusual circumstance at this time of year, and it was impossible to get out; while, as our arrangements for carriages had all been of necessity, made in advance, we could not find another day for the expedition, and had reluctantly to give it up.

Forest of Montrieux.—After a night somewhat disturbed by the roaring of lions in a menagerie hard by, we made an early start in a large omnibus to visit the forest of Montrieux, which is situated in the hills, at a distance of about twenty miles north of Toulon. After passing Mont Faron, which rises close behind the town, an excellent road led us over a plateau between olive gardens and ruined vineyards, and thence down into the valley of the Capot stream, which the previous day's storm had raised to flood level. When nearing our destination we turned down a narrow lane, dashed across a torrent, and then walked through a forest of oaks and pines to the convent of Montrieux-le-Jeune, where we had breakfast. M. Madon then gave us some information about the culture of the olive in this region. The trees are grown up to an altitude of about 1,300 feet, the produce being very variable according to soil and situation. There are two varieties,—the larger of which yields, in favourable localities, a good crop every three years, worth from £8 to £10 an acre; the smaller kind yields a good crop every two years, but the net returns are much the same. The trees, which are always grafted, are usually planted in clusters of two or three together, the group being pruned in various ways, frequently with a hollow centre, so as to favour the production of fruit on the inside as well as the outside surface of the "vase" thus formed. Shoots appearing on the bole of the tree or springing from its base are kept carefully pruned back, the leaves and twigs thus removed being buried below it, so as to avoid taking more than necessary from the soil. The crop is gathered from November to January, the fruit being picked up from the ground, and also plucked; it is then taken to a mill, turned by water-power or by horses, and crushed, with its kernel, in order to extract the oil, the most expensive kind being that which comes from the unripe olives. The trees have lately suffered much from attacks by an insect, the larva of which is developed in the fruit.

M. Madon's little lecture finished, we started to walk through

the forest, sending our omnibus to await us at Belgentier. The forest, which is State property, has an area of 2,700 acres. Like that of St. Baume, it was protected as ecclesiastical property up to the time of the Revolution, and it used to yield a considerable proportion of the oak timber required for the navy; but over-cutting and insufficient protection have now reduced it to a very poor condition, and trees capable of yielding wood of this class are nowhere to be seen. It is difficult, indeed, to realise that they ever existed; but it is said that they were all taken out during the Revolution and the first Empire, and that the forest has never been allowed to recover. The lower portion, where we entered it, is now stocked with *Quercus Ilex* and *sessiliflora;* the former cut at a young age for tanning bark, and the latter, worked as a simple coppice, being cut at the age of twenty-two years for conversion into charcoal. Bark and charcoal can be profitably exported, the gross annual revenue from these sources being about 3*s.* 3*d.* per acre; but there are very few roads now existing in this locality, and it would not pay to export firewood; so that the small wood, which cannot be utilised for charcoal, is left upon the ground, where it rots in a couple of years or so. The heads of the Department are anxious to raise a high forest of pines in place of the present crop, but the local officers are opposed to this project, as they are afraid of fires. The charcoal is burnt during the winter, so as to avoid danger from this cause.

Regarding this part of the country, generally, it may be said that the rock is limestone, the principal trees being the Aleppo pine and the evergreen oak; the ground is steep and difficult, so that the forests do not yield much. There is no doubt that timber of large size grew in former days on these hills; but at the end of last century the country fell into disorder, M. Madon's grandfather, who then occupied a high official position, having to go about under the protection of a pair of ferocious hounds, and having to treat with brigand chiefs for safe conduct through it. At that time the people were not under any sort of control, and the entire district became denuded of trees, from which condition it seems almost impossible that it can ever recover; for the ground is owned principally by communes and private proprietors, who cannot afford to refrain from cutting in order to allow the forests time to grow up. They have to pay taxes, and must get revenue; while the stock being very small, it must be worked over at short intervals, and no accumulation of capital is possible. Say, for instance, that the forests yield a gross revenue of 3*s.* 6*d.* an acre, the cost of working, with maintenance and taxes, comes to something like 2*s.* 6*d.*, and not much saving can be effected out of the balance. But it would be a very great advantage if the State would set an example, by showing the people what the soil is capable of producing under proper treatment; and

a portion, at least, of every State forest in this region should, for this, if for no other object, be brought as soon as possible into a good condition. In most mountainous districts the fairly level ground is cultivated; but forests grow well on slopes up to 35°, the working out of the timber being both difficult and costly when the fall is much greater than this. Such steep ground had better be kept under simple protection, letting the forest grow up as much as it will, removing none but dead or dying trees, and spending time and money on those parts of the area only which are likely to pay well. At Montrieux, for instance, there are said to be 1,100 acres of rocky ground, which, if left alone, would grow a light crop of trees, affording protection to those on better soil, and at the same time giving seed; here all efforts should be concentrated on the remainder of the forest, so as to bring it into the best possible condition, as an example to be followed by degrees by the neighbouring proprietors. The moral to be learnt from a study of these hills is that all existing forests should be most jealously guarded against the destruction, which must sooner or later over-take them, if they are not rigorously and efficiently protected against over-cutting, fires, and grazing. When once they have been ruined, those which are not State property can hardly ever be resuscitated, and even if success be attained it is at an enormous cost. While we were pondering on these questions, the rain, which had been threatening for some time, burst upon us with the violence of a tropical shower, and we had to find our way to Belgentier in a drenched condition, down a path which was converted for the moment into a little torrent, through which we had to wade. On arrival we found that, to make matters worse, our carriage had not arrived, and we had to wait an hour for it to take us back to Toulon.

The Maures.—From Toulon we took train to Cuers, in order to visit the Maures, a low range of hills rising to a height of 2,500 feet, near the sea-coast between Toulon and Fréjus. This range, which has precisely the same geological formation as the Vosges, is extremely like them in appearance; the rock is principally granite, gneiss, or mica-schist, and there are numerous springs throughout it. The chain is continued beyond Fréjus by the hills of the Esterel, which extend eastwards to Antibes, and differ from the Maures in that the rock is chiefly porphyry, the numerous clefts and cracks in which permit the water to drain off with rapidity, and hence the soil is dry, poor, and shallow. The abrupt cliffs which mark this part of the range form a noticeable contrast to the rounded, grass-grown summits of the Maures.

This region is protected from the cold north winds by the Alps, but receives the warm Mediterranean breezes; and hence the climate is very mild, permitting the culture of the olive and orange, as well as of the vine and cereals. Wherever water is

found in sufficient quantity, pasture is practised very extensively; but this is not possible everywhere, and large areas are maintained under forest. The vegetation differs very much from that of the north of France. Here we find among the larger trees the Aleppo pine and cluster pine (*P. pinaster*), with the stone pine (*Pinus pinea*) growing occasionally near the sea; and among broad-leaved kinds we have the cork oak (*Q. suber*), which is not found elsewhere in France except in the Eastern Pyrenees, the Spanish chestnut, which is grown for the sake of its fruit, the pubescent variety of *Quercus sessiliflora*, and more rarely the ash and maple (*Acer campestris*). Among shrubs there are the wild olive, the dwarf oak, the juniper, the arborescent heather (*Erica arborea*), the arbutus, oleander, broom, and others; while among smaller plants may be mentioned the common heather (*Erica scoparia*), myrtle, lavender, cactus, and cistus, *Chamærops humilis* and the date palm flourish in this locality, and distinguish it botanically from the rest of France. It is the region of conifers and of the cork oak, the produce from the latter being exceedingly valuable, and increasing in price every year.

An omnibus met us at Cuers, and carried us some miles on the road towards Collobrières, where we were to pass the night. We stopped for a few minutes at Pierrefeu to look at the country. The village, which is built on granite rocks forced up by volcanic action, overlooks an extremely fertile cultivated plain, across which we saw, towards the north, limestone mountains of the same formation as those we were on the previous day, the plateaux and steep scarps of which reminded us of the Jura; while towards the east and south the rounded tops of the Vosges-like Maures were visible. The numerous spurs constructed to keep the stream within its bed showed us that we were no longer on the limestone. Here, in the Maures, the slopes rarely exceed 30°, and the construction of export roads and work of all kinds is consequently comparatively easy. After driving a little further we left the road, and mounted the hill-side through a forest of pines, partly Aleppo and partly cluster, with some evergreen oak in places, and a dense growth of the arborescent heather. The forest is communal property, and its area is about 7,500 acres. The cluster pine cannot here be grown profitably for resin, as the soil is too dry to produce it in sufficient quantity; the pines are, therefore, felled under the selection method, at a minimum girth of 3 feet 8 inches, and are cut up into planks, the price per tree in the forest being 4*s*. The evergreen oak is worked for bark as a simple coppice. A little further on we came upon some cork oak, and the number of that species increased as we advanced. This tree constitutes the principal wealth of the country, the crop being a very profitable one, as owners of cork forest are able to count on a revenue of 25*s*., and get, in rare cases, as much as £19 an acre. Such forests,

of course, cannot be bought under a very high figure. About this part of the Maures the State does not possess much of the forest, about 37,000 acres being owned by private proprietors, and about 7,000 acres by village communities. Communes possessing forests of this kind have large revenues, and as a rule they have constructed fine roads and bridges out of them; but it is remarkable that, their credit being good, they are nearly always heavily in debt, Pierrefeu being said to have an annual income of £2,000 a-year, while its debt amounts to about £15,000. We were told that ten or a dozen of the inhabitants of Collobrières possess fortunes amounting to £40,000, one of them having £200,000, all made by cork and Spanish chestnut, of which large quantities are grown higher up the valley. These men are content to wear blue blouses, and to live in the same style as their poorer neighbours.

M. Madon described to us the method of treating the cork oak. The removal of the cork is effected as follows:—An annular incision is made near the base of the tree, and another at a height of about 4½ feet above it, these being joined by a third incision carried vertically down from the upper to the lower one. Great care and long practice are necessary to enable the workmen to perform this operation without cutting into the matrix. The cork is then raised with the blade of the axe and the wedge-shaped end of the handle, and if it does not come off well it is struck with the back of the axe-head to loosen it; but this again must be carefully done to avoid injuring the matrix, on which a new growth of cork is to form. The layer of cork first taken off is of no value; nothing can be made of it. The second and subsequent growths, which are comparatively smooth, and form the cork of commerce, are removed when they have attained a thickness of nine-tenths of an inch —that is to say, after intervals of from six to ten years. May and June, when the trees are in full sap, are the months usually chosen for this operation. After the lower ring of cork has been removed, a second one is taken off higher up, and so on up the trunk of the tree and its lower branches. In the case of trees of small girth, the addition of an inch to the radius involves a greater proportional increase in the circumference than it does in the case of large ones; and the cork growing to that thickness on small trees is liable to crack and split into vertical furrows, which, when they are irregular, greatly diminish the value of the cork. On this account it is usual to make two vertical incisions on opposite sides of the young tree, which gape wide with its increasing growth, but which avoid the formation of the objectionable, irregularly-shaped, natural furrows that would otherwise have been formed. The rule is to take off only one ring at a time, and to allow the tree an interval of two or three years' rest before attacking it again; but this wholesome restriction is not always observed, and it is

not uncommon to see trees which have been stripped, at one time, of their covering of cork throughout the greater part of their stem and large branches, this leading frequently to the deterioration or even the death of the tree so ill-treated. Trees that have been barked in the manner above described, present a peculiar appearance, the cork of different ages having various colours, from the red of the youngest to the grey, rough, moss-covered natural growth on the upper part of the tree. Experts can tell the age of the cork by its colour and general appearance. The outer surface of the second and subsequent growths of cork, though smooth and clean by comparison with that of the natural layer, is hard and gritty, and has to be scraped off. This causes a loss in thickness; and a system has been devised by M. Capgrand-Motte, under which the growing cork is protected by a covering—a sort of jacket, in fact. This method was highly thought of at first, but it is now believed to be the cause of a fungus growth which has appeared on a large proportion of the trees so treated, and it has been abandoned.

The trees are nearly all coppice-shoots. Stems of less than 16 inches in circumference are not worked. It is said that a seedling tree will not here attain this size in less than forty years, whereas a coppice-shoot will do so in fifteen years. The collection of cork from the forest we visited has now been going on for about sixty years, and it is believed that the trees can be worked up to a great age. The yield per tree depends of course on its size; but it has been calculated that a square foot of matrix yields on an average $1\frac{1}{5}$ lb. of cork every eight or nine years. The price is very variable, rising sometimes to 50*s.* per 100 lbs., but more ordinarily the rate is 25s., the cost of collection being 3*s.* 6*d.*

The financial difficulties in which most of the communes are involved, lead to the result that, notwithstanding the intervention of the Forest Department, their forests are not, generally speaking, kept in such good order as those of private proprietors. It is a common practice with them to farm out the collection of cork on twelve-years' leases; but this, generally, or at any rate frequently, leads to the contractors taking off all the cork of marketable thickness in the last two seasons, and handing back the trees in a condition in which they cannot yield much more for several years. The system should be discontinued.

The cork oak is a tree of light cover. Here it grows mixed with the cluster pine; but there can be no doubt that the proportion of pine, which tree is of very small value as compared with the oak, is far too large, and that the cover is in many places too heavy, so much so that the development of the oaks is seriously impeded, while in places they have been completely killed, many of the pines being also dead, and left standing at the risk of their breeding insects. That the cork oak does not

entirely disappear under this treatment, is due to the fortunate circumstance that it can support a fairly heavy shade without actually dying outright; and that under it the trees continue to live in a stunted and unhealthy condition, giving a certain amount of seed; so that, except in the densest parts, there are nearly always some suppressed oaks of various sizes, even where the heather is very thick. We passed a piece of private forest in which precisely the contrary conditions prevail, the whole of the pines having been cut out, and a pure oak forest remaining. This has resulted in a very rapid growth of the young oak, and possibly it may turn out to be the correct method of treatment; but the opinion of the Forest officers present seemed to be that it should not be generally adopted, for the present at any rate, both on account of the objections which exist to the maintenance of pure forests on general grounds, and also because, however well the oaks might grow, if left to themselves, without the shelter of the pines, it is by no means certain that they would prosper equally well when deprived of the shields of cork, with which nature has furnished them, doubtless to enable them to resist the fierce heat of the southern sun. It seems likely that under these conditions it is necessary to afford them some shelter, and that complete exposure, by the entire removal of the pines, will not have a good result. The proper plan seems to be to leave just enough pines to afford the needful shelter, and no more; certainly the cover of these trees should not be allowed to suppress the oaks.

(*To be continued*).

FIRST IMPRESSIONS OF BURMA.

HAVING many friends in India, of whom some have just come out from home like myself to join the Forest Department, while others are already engaged in the various branches of the Civil and Military services, I thought the best way for me to communicate my experiences to them would be through the pages of the "Indian Forester." Under these circumstances I hope my readers will bear in mind that the following sketch really does set forth my first impressions, so that the criticisms of brother officers in Burma, who have lived and worked in that country for long years, will not be too severe on my audacity and inexperience.

I propose then to relate what I actually did and saw on a week's tour during my first month in Lower Burma.

But before setting out, it is only right that I should say a word about the station at which I am posted. It is a pretty little village on the Irrawaddy, the houses being ranged along the river bank, where they are beautifully shaded by palm trees; at this season the river drags its slow length along some 50

feet below the top of the bank, but in the rainy season, were it not for an embankment which runs all the way along, the whole country would be flooded, and for this same reason all houses are built on piles from 2 to 8 feet off the ground.

My work here is mainly to superintend drift operations on the river, as immense numbers of rafts of teak are floated down almost daily, the greater part of them belonging to the Bombay Burma Trading Corporation, Limited. These rafts have to get their passes examined at certain places on the river, of which my head quarters is one. Another reason, I believe, for my being sent here was that there is a proposed reserve of teak on the range of hills which separates Pegu from Arakan, but owing to the unsettled state of the country the work of demarcation has to be deferred.

It was on a cold misty morning that I left my bungalow with a small retinue, composed of one Ranger, four Forest guards and two servants, all on foot, as I had not yet been able to find a suitable pony; and as one can never be sure of not coming across dacoits, I carried my own shot gun myself, while my men had three old muskets which I had borrowed for them from the Police. The country we went through was all paddy fields, which are tedious to travel over, and offer no diversions of any kind, except a stray shot at a vulture or other bird as yet unknown to the débutant. Some eight miles of this brought us to a village where we waited till the bullock carts arrived and then had breakfast. Meanwhile the inhabitants were having some sort of festival, and trotted out a great god of bamboo and pink paper before the house where I was, and there danced and played and gave me presents of plantains, melons and sticks of bamboos containing cooked rice.

In the afternoon I started out again, and at six o'clock arrived at a small Karen village, where we should have arrived some time before if we had not taken short cuts. Here I found a French Missionary with his house and chapel surrounded by a strong stockade to keep out dacoits; being a native of Lorraine, he was able to talk of Nancy and old times, and so we passed a pleasant evening after the day's march.

It must require a considerable amount of devotion to lead a life like this, I think, for these Missionaries are no carpet knights, but live in utter poverty, obscurity and solitude, with scarcely any prospect of ever returning to their native land.

The next morning my host gave me a lot of information about the neighbourhood; how they tap some trees to make torches, strip others to make ropes, and commit even more serious offences. I found that he had distributed copies of the Forest Act in Burmese among his people, so that they at any rate should know the law. It is often said that the rules are unknown and impossible for the people to understand, though I must say I can see no difficulty in them myself.

In the afternoon I went out on to a lake close by, and found there plenty of teal, also quantities of another large blue bird resembling a water fowl, but these latter were too tame to be worth shooting; the teal, however, were wild, which shows that the Burmans have learnt to appreciate their excellence.

Next morning I set out very early to escape the heat of the day, and just after starting heard the Angelus softly ringing over the tangled forest, where it mingled with the shrill crows of the jungle cock and the chirping of the crickets on the tree tops. This march was a very agreeable one, the road lying through shady forest and taungya plantations; I found several jungle fowl and bagged a couple for breakfast.

The Karens in these parts still use the cross-bow, with which our forefathers are said to have done such execution; it is a very formidable weapon, and a bamboo arrow shot from one would pierce a deer, or man even, with ease: I watched them shooting squirrels, at which they are very clever.

This night I slept in a large village where a detachment of sepoys are now stationed, as the scene of an outbreak of the dacoits last year, when the police station was burnt. There is one great convenience that one meets with in travelling in Burma —or at any rate in these parts—and that is that one finds every where rest-houses built by pious Burmans for wayfarers, which, with the help of a few curtains from the village, form as good a home as one can want in camp; and even where there are no good rest-houses available, one can always put up in a Burman's house, where the proprietor is delighted to turn everything inside out to make one comfortable, and gives one everything of the best he has. I believe in India it is far otherwise.

The next morning I had an enjoyable ride through a very wild jungle, where the cocks were crowing all round us, and here I was lucky enough to come across a brood of wild chickens, of which I captured a couple to bring up at home. The village I finally arrived at is on the extreme limit of civilization, being at the foot of the Arakan Yeoma, on which one sees never a vestige of human habitation. Some mounted police are stationed here, and other parties are posted in some half dozen similar villages between which they patrol daily, so as to form a cordon to keep out dacoits. I was happy in finding three Police officers here, with whom I went out shooting in the evening, but we only got one hare and some jungle fowl, of which the greater number fell to my own gun.

But beside shooting, I had other objects in coming here. Before leaving head quarters, I noticed in a large village on the river some dozen or twenty houses occupied in making rope from *Shaw* fibre collected in the jungles where I now was, and seeing that by stripping off the bark the tree is killed (albeit useless for timber), while the people pay some 12 or 18 Rupees per 350 lbs. I do not see why they should not pay a small duty

on it as for other kinds of forest produce which form articles of commerce, such as cutch and wood-oil.

A second reason for coming here was that an alleged coal-mine had just been discovered; so early next morning I rode some four miles up a dried-up stream into the hills; here we found the forest primeval, but stripped of all its leaves which strewed the sun-parched soil, from which however delicate white crocuses thrust their heads, while in still greater contrast orchids of rare beauty drooped from the leafless boughs making an exquisite picture of still life.

After passing a precipitous rock, on the summit of which I was told the Chins have for long ages buried their dead, the guide lead us up a small nala, and presently brushing away with care the dead leaves covering the bank, revealed the coal mine, which was no less than a handful of black dust in the bank side. I turned homewards and galloped in to breakfast.

In the evening I rode six miles to another village with one of the Police officers, where we found a large deserted house, and made ourselves comfortable for the night. Next morning I went and marked six tons of dry teak, which had been collected in the jungle, and were being worked by a large timber merchant. Afterwards we had some rifle practice with my ·577 express at 300 yards, with great success, though for sporting purposes I fear it is much too heavy for Lower Burma.

In the evening we had a beat and found plenty of jungle fowl and black partridge. I also shot a deer under rather strange circumstances; the beat was over and the men had closed in round me when the deer came charging through from behind right up to my interpreter, to whom I had given an old musket, with directions to fire at deer if he got the chance; well, he did fire and missed of course, whereon the deer came on to me, and I, having no time to change cartridges, gave him a charge of No. 4 which failed to stop him. I instantly started another beat hoping to get him, but before the beaters had gone ten yards they found the deer stone dead, three of my pellets having reached his vitals, so he was slung up and brought home in triumph.

My next stage brought me through some Shan villages to a small town on the river bank, where a lot of timber is consumed for boat-building. The Burmans here have a very ingenious way of making their canoes, though I dare say the same method is practised elsewhere. The first time one sees these boats, one would think they were simply carved out of a huge log some 3 feet 6 inches in diameter, as it is all of one piece, except sometimes when a thin plank is laid along the edge to make the boat deeper. The method employed is as follows:—A log of green pyinkado, some 25 or 30 feet long and 18 or 20 inches in diameter, is roughly hollowed out, except at the two extremities, where it is left solid for a foot or two: a fire is then lighted

underneath, so as to heat the bottom, but without burning it, the inside being meanwhile basted with cold water: fork-shaped pieces of wood are then placed on the edges of the boat, to which are attached levers which are pressed down gradually for some ten days and tightened by ropes, while sticks are laid across the boat inside to hold it open; in this way the sides are bent outwards until the original span is doubled. The whole process takes about ten days, after which time the boat in section forms a regular semicircle of about 3 feet across, which shape it retains indefinitely. These boats fetch from Rs. 30 to 50, and are immensely used,—each household having at least one of them, to supply the only possible means of locomotion during the floods. These boats, however, have the drawback of sinking when full of water, the wood being very heavy, but this can be remedied by fastening a bamboo along each side which renders it quite safe, but at the same time diminishes the speed.

I marked about fifty of these boats, beside a lot of logs and planks, and so had no time that day to go out shooting; though I was told that by going out in the early morning one could be sure of getting some deer in a place close by.

The next day I went and visited a cutch-boiling neighbourhood. These places look very weird, as one first distinguishes through the morning mist the cauldron seething in a cloud of smoke, but perhaps I may as well describe the entire scene.

In front of the hut where the cutch boiler lives, a trough is dug in the ground some 8 inches deep in the shape of a horse-shoe; the trough is filled with chips of wood to serve as fuel, while on it are placed from 20 to 30 pots or oil tins, filled with chips of the cutch wood, which are chopped about an inch square, and pressed down tight into the pot: water is then poured in, and the wood underneath is lighted. After boiling thus for a short while, the liquid is decanted into a large pan, which is boiling over a separate fire of greater heat, and as the liquid in this cauldron boils away, it is replenished from the smaller tins from time to time, until the required degree of viscosity is arrived at, when the cutch is taken out and put into a box where it cools and hardens.

Each cutch-boiler pays an annual tax of Rs. 20 to Government for each cauldron he has working, and in a good day's work he may make one panful, which weighs about 35 lbs., and is worth about Rs. 4. Cutch already forms a very important item in the revenue of the Forest Department, and in this district at any rate it certainly might be made to give a good deal more than it does.

The Subordinate staff here is utterly inadequate to the work, both in number and quality.

In the jungles the villagers can do whatever they like, without running much risk of ever being disturbed by a forest guard. Besides, the pay of a forest guard is only Rs. 12 a month, which

is not sufficient to supply the bare necessities of life, they would get better wages as coolies. Moreover, they are mostly married men, and honesty becomes a moral impossibility, the result being that the revenue is about half what it ought to be, while an unscrupulous guard can make his hundred a month. But to return. After examining the cutch licenses I made for home, and on my way passed a village which had been burnt by dacoits the night before, and presented a scene of utter desolation.

One old woman had not been able to escape from her house, and perished in the fire, and I saw a young fellow who had been fearfully cut about with *dahs*.

The last incident of this expedition was of a still more painful character—to me. The pony I had been riding a week, I had borrowed by proxy the first day of my tour, so I did not even know who the proprietor was. I was gaily trotting along the road, coming into a village about 6 miles from home, when suddenly the pony showed a frantic desire to plunge down the embankment, I resisted and a struggle ensued, which presently terminated in finding myself on my back against the door of the pony's home, when I got up and walked sadly to my camp.

BURMANICUS.

CODE HEADINGS.

I THINK it is time that some decision should be given by high authority as to what constitutes the difference between I. or departmental work, and II. or non-departmental work.

I had hitherto been under the impression that the distinction lay in the *removal*, and the Code Forms seem to confirm that impression, for they still describe R I. and A I. as "timber and other produce *removed* by Government agency;" and R II. and A II. as "timber and other produce removed from the forests by consumers and purchasers."

I was told the other day, on very good authority, that the real distinction lay in the *cutting*: that if Government spent a single pice on *cutting* the material, the charge should go to A I. and the revenue to R I.

If this is the case, it ought to be more generally known; for in my Province, I am sure, that after Government money has been spent in *cutting* material, which has been sold at once before removal, and then removed by the purchasers, the revenue has been credited to R II.

In olden days, the distinction between I. and II. was very clear. Probably the type that the first compilers of the Code had before them was of I. work, the departmental work in the hill divisions of the Punjab, where every stage of the work, the felling, logging, sawing, shooting, carrying, rafting to depôt, &c., was done entirely by Government from beginning to end.

And perhaps the type of II. work was taken from the khám tahsil system at that time obtaining in parts of the N.-W. Provinces, where not a penny was spent under A II. except in the form of establishments, while all the revenue went to R II. with no guarantee of reproduction.

Since those days, however, the two types have considerably approached each other, and under the so-called khám tahsil system, we now see restrictions of every kind, fire protection, closed blocks, reserved species, trees felled under supervision, trees marked by the Department, &c.; and under I. in the form of improvement fellings, we see Government conducting the felling, and disposing of the produce sometimes by direct sale to purchasers before anything has been fashioned or removed, sometimes after removal from the coupe only, and sometimes by carriage to a sale depôt.

But the way in which the question affects the Department is this. Many people, Secretaries of State for India, India Offices, and perhaps even Indian Finance Committees, judge us by the results under the two comparative systems. The two systems are still under comparison, and on probation as it were. Should it finally be decided that II. is better than I., then I. must be abandoned, and *vice versâ*.

Hitherto, the comparison has been unfavourable to Departmental work; and if we continue putting our charges to I. and our receipts to II., we increase the unfavourableness of the comparison to departmental working.

If such things have hitherto been done, they have been done in ignorance, and from adhering to the word "removal."

If the cutting is the proper distinction, then the sooner the proper authority speaks the better, and alters the wording of the Budget sub-heads.

SCARABÆ.

TIGER AND PEAFOWL.

IT is perhaps generally thought that the presence of peafowl on the ground indicates that there is no tiger in the immediate vicinity, but the following tale will show that such cannot be relied on, and how I lost a chance of bagging a magnificent tiger through the untimely warning of a peafowl. I was camped near the river Nerbudda, and it was the hot season when the fires had already passed through the forests, and laid the ground everywhere as bare as a rock. I had with me a couple of local shikaries of the kurku caste, whose capabilities as sportsmen are perhaps unrivalled by those of any other caste; at any rate these two men were first class in tracking up and finding game, and could be relied on for an emergency. When starting for work one morning I told one of these kurkus to cast his eye round for game. On my return to camp about

midday I found him awaiting my arrival, and a twinkle in his eye showed that he had good "khaber," and sure enough he had been looking from a ledge of rock at a huge male tiger fast asleep in a pool in a gully below not 15 feet distant. I asked him why he had not fired, for I had given him my 10 bore rifle—the faithful old chap (he must have been fifty or more) replied he would not dare to spoil saheb's sport. Well! after a hasty meal we set out—it was only a distance of a couple of miles. On arrival at the spot, knowing from experience the "luck" that attends tigers, I proposed that some one should be posted in the ravine above, but my old companion was so "cock sure" of the whole concern, minutely explaining how he had sat for a good while watching stripes, and had examined the locality, &c., that I gave in. On nearing the ledge I took off my boots, and went along very warily determined to have a good view of beauty before firing, and I had only another five paces to reach the point, when up flies a peahen from actually the very place where the tiger was sleeping. I rushed forward, but only to see marks of his wet paw on the rock as he bounded up the ravine,—and he was seen by those behind making tracts clear away into the wide forest. It was indeed a most perfect spot to have caught old stripes, and I might have looked at him at quite close quarters for hours and then potted him at my leisure, but his time had not yet come, and I returned somewhat down with my luck.

20th April, 1887. D.

GRADING OF FOREST RANGERS.

I BEG to send you the following few lines, and hope you will publish them in the "Indian Forester."

It appears from the last issue of your valuable Journal, that Forest Rangers in the North-West Provinces are placed on the same status as Inspectors of Police. But the case is quite different in the Punjab. The Rangers there have as yet no recognized status, though much protective, as well as revenue, work is required from them. They come in contact with Police as well as Revenue officers, perhaps more frequently than they do in the North-West Provinces. In the Vernacular Government Gazette they are designated as "Girdáwar Jangli."

In the Revenue Department, Girdáwars draw about Rs. 20 or Rs. 15 per mensem, and hold positions under Tahsil Canongos. So the translator considers that Forest Rangers are of the same status as Girdáwars. To the misfortune of the Punjab Rangers, he further adds the word "jangli," which may mean that the Rangers are *illiterate* or *savage*, or something of that sort. "Girdáwar Jangli" does not convey the proper idea of the duties expected from Forest Rangers. If the Rangers of the

Punjab do not deserve any recognised status, they may be spared from the designation of "Jangli Girdawar."

A READER.

MALJHAN FIBRE FOR PAPER MAKING.

THE Secretary of the Lucknow Paper Mills informs us that it will not pay to use the Maljhan* fibre for white paper. This fibre takes a lot of caustic to boil, and also a very large quantity of bleach. They can only use it in making brown papers, and will pay a rate of Rs. 1-6-0 to 1-8-0 per maund, delivered at the Lucknow Railway Station. Their yearly consumption will probably be 3,000 or 4,000 maunds.

PLANIMETERS.

I THINK it will be useful to suggest that all Divisions that are provided with maps should also be provided with a planimeter to take out the areas of fires. The returns of fire-conservancy suffer, I feel very sure, from the habit of finding the areas by rough and ready means, and moreover these rough and ready means are in reality only rough means, and not at all ready, since the planimeter is very much more quickly worked. The instrument would also be useful in a hundred other ways.

Q.

CLEARING CONTOUR BANDS THROUGH DEODAR FORESTS.

YOUR P. D. is napping again. At page 225, Vol. XIII., May number just received, he makes me say "and the soil is also prepared or worked up; near seed-bearers large blanks are planted." Now seeing that I am strongly in favor of doing as little planting as possible, I should not be likely to plant "near seed-bearers" of all places in the world! The semi-colon should be after the word "seed-bearers," and the meaning will be entirely altered.

J. C. McD.

M. REUSS has requested me to notify, through the medium of your columns, that his work on the International Forestry Exhibition, held at Edinburgh in 1884, is procurable at Berger, Levrault and Cie's, Nancy; the price is 3·75 francs = 3 shillings.

FRED. BAILEY.

Bauhinia Vahlii.

II REVIEWS.

THE EDINBURGH FORESTRY EXHIBITION OF 1884.

If the Forestry Exhibition held in Edinburgh in 1884, was not of a nature to attract much attention in England, where the science of forestry is but little understood, or cared for, it was not suffered to pass unnoticed in countries, which are dependent upon forests for much of their material wealth and prosperity. Thus the little book before us, which, in addition to an enumeration of the articles sent in by the various countries to the Exhibition, gives a bird's-eye view of the present state of forestry all over the world, has been judged worthy of extended notice, and quotation, in the official Bulletin of the Ministry of Agriculture and Commerce in France.

To the officers of the Indian Forest Department, who so largely contributed to the success of the Exhibition, it should be especially interesting. For it is written by one of the Professors of the Forest School at Nancy, which is proud to claim no less than sixty of the Conservators and Assistant Conservators, now serving in India, as former pupils. It is impossible to note the warmth of feeling, which the author uses in expressing the interest felt in France, in the after career of his old comrades, without giving voice to a sincere hope, that the advantages offered by a course of study at Cooper's Hill, may be found to justify the change now made in the training of cadets for the Indian Forest Department.

Great Britain.—The pride of place has been assigned to Great Britain, from motives of international courtesy, and because the Exhibition was held within her borders. But she owes this position less to her own merits as a timber-producing country, than to the light reflected on her by India and her Colonial possessions. With the single exception of the Dean Forest, there are no forests properly so called in England. For it is impossible, either from an economic or scientific point of view, to concede this title to Windsor or the New Forest. The former exists really as a park, where beauty of scenery, and the maintenance of a sufficiency of game are chiefly studied, the latter is a simple common, with a few relics of its departed glory, as a forest for the supply of oak to the dockyards of

* Exposition Forestière Internationale de 1884 à Edimbourg Ecosse par Mons. E. Reuss, Inspecteur-adjoint des Forêts, Nancy.

England. The woods and plantations of Scotland, belonging to private proprietors, and being under individual, though it is fully admitted most competent, management, offer few data likely to be useful to the executive forest official. The greater number of the exhibits of Great Britain therefore furnished rather objects of curiosity, than matter for useful remarks to lovers of sylviculture.

But the specimens of wood sent from the Dean forest, sections showing the effects of lopping and pruning, and above all, the table of measures relating to the growth of oaks, kept for a century, by successive administrators, accompanied by logs of oak grown under different conditions of soil and cultivation, and of ages ranging between 30 and 228 years, redeemed England from total nonentity, and were sufficient to place a scientific stamp upon her collections. The exhibits of the Scottish Arboricultural Society also come in for their due meed of praise, as affording instruction to practical foresters.

The Indian Empire.—British India, however, presents an entirely different state of matters. "Not only is there a stretch of forests nearly as large as the whole territory of France, but a considerable portion of this belongs to the Government, who has entrusted the charge of it to a Scientific Department recruited and organised according to rules analogous to those which are in vigour in the forest countries of Europe."

The readers of the "Indian Forester" are already well acquainted with the position of the forests of that country, and we may briefly say that in addition to a resumé of the constitution of the Forest Department, taken chiefly from a Preface written to the Indian Catalogue by Sir George Birdwood, the present division of the Indian forests into reserved, protected and private forests is fully entered into. It will be well, however, for those who study the financial statement, to note that the unhappy rupee has dropped from its par value of 2 francs 38 cents, in which the figures are given, to something under 1 franc 70 cents.

The principal exhibits from India which attracted the attention of our author were the "Index Collection," the specimens of teak showing the growth of successive years sent from the Nilambúr plantation, the gums and resins, and last in order of place, but first in his idea of merit, the Literature and Cartography. It is worth while quoting what he has to say on this subject, which is as follows:—"In our opinion this is the group which allows us best to judge of the degree of perfection to which the technical value of an Administrative Department has attained. The Indian Forest Department has nothing to fear from the results of such criticism." The forest maps, the various publications of the officials of the Forest Department and the "Indian Forester" are mentioned with special praise. And it is pleasing to note the separate paragraph which the

author devotes to the "Envois provenant d'anciens élèves de Nancy."

Africa.—From India our author passes on to Africa, which was represented at the Exhibition by the Colonies of Gambia, Sierra Leone, the Cape and the Island of Mauritius.

In *Gambia* and *Sierra Leone* the forests belong to the State, but they are in course of disappearance under the axes of the woodmen. Specimens of woods, gums, fibres and oils were sent by the Governments of these two Colonies, but our author does not consider them worthy of more than passing remark. This was probably owing to the difficulty of identifying them from their descriptions in the catalogue, sent along with them, which to put it mildly, was very abstruse.

Cape Colony.—The Colony of the Cape offers more attractions for Monsieur Reuss, possibly from the fact that the Forest Department there is administered by one of his compatriots, M. de Vasselot de Régné, who had already distinguished himself in France by his re-afforestation of the "dunes" of La Conbre. The forests of the Cape, have suffered severely from the same wasteful system, which did so much harm in many parts of India, where it was known under the name of the Voucher and License system. No control was exercised over the action of the license holders, and the trees growing in the most convenient and accessible situations were cut down without any regard to their age and ripeness. The same want of the raw material was felt there, as in the early days of the establishment of a Forest Department in India, and M. de Vasselot proposes to send to the Forest School at Nancy a certain number of the young Colonists, who, on their return, will be able to take the place of forest officials. The exhibits sent home consisted principally of logs of "yellow-wood" of various growths, specimens of barks, models of ox wagons, &c., and administrative reports and documents.

Mauritius.—Here again the same story, of waste and tardy prevention, repeats itself. The large surface formerly covered by forests has gradually diminished, with the result, according to our author, that the value of the wood exported in the decennial period between 1863 and 1872 was 67,075 francs only, while the value of the wood imported in the same period was 7,617,850 francs.

Cyprus.—Soon after the British Government had taken possession of the island of Cyprus it appointed, on the recommendation of the French Government, another Inspecteur Adjoint des Forêts, Monsieur P. G. Madon, to report upon the state of the forests of the island, and the measures necessary for their preservation. At the date of the holding of the Exhibition, Dr. Dobbs of the Indian Forest Department was in charge of the newly created branch of Government for Forest Conservancy. This officer forwarded to the Exhibition specimens of woods—

chiefly the laricio pine, cedar, and an oak peculiar to the island —cones and resins.

Ceylon.—Returning to Asia, our author notices the state of the Ceylon forests, which he says cover 39 per cent. of the total territory of the island. Here also the services of the Indian Forest Department were called into requisition, and a forest administration has been established on the report of Mr. F. Vincent, sent on a special mission in 1883. The principal object of this new department will be to re-afforest the tracts denuded for the now useless cultivation of coffee, and to introduce, where possible, plantations of teak, which has been grown from seed imported from India, with considerable success.

Malay Peninsula.—In addition to the specimens of wood sent by the Governments of Singapore and Perak, a most useful book of reference, entitled "Notes and Experiments on Timber in ordinary use," was sent by Mr. H. Newton of Singapore.

Johor.—An English Company has established an important saw-mill at Johor, where they farm the forest domains of His Highness the Maharajah. The wood is brought to the factory in the rough, and is then exported cut in suitable pieces. The representative of the Company displayed a very complete collection of the woods usually found in Johor, which attracted much attention from the visitors to the Exhibition.

Borneo.—Another English Company did their best to illustrate the forest resources of Borneo, but there is as yet no Forest Administration in this important island.

Australia.—Visitors to the Indo-Colonial Exhibition held in London last year know what magnificent specimens of the eucalypti, the jarrah and other woods were there shown by the various Governments of Australia. Our author was not, however, fortunate enough to see them at the Edinburgh Exhibition, where the only exhibits from Australia were those sent from the Royal Gardens at Kew. The Conservator of Forests at Adelaide, was the only official, who contributed directly to the Forestry Exhibition, by sending his magnificent "Forest Flora" and other minor works on Tree Culture, &c.

America.—Our guide now takes us to America, whence so far as the British Colonies are concerned, contributions were sent from Canada, British Guiana and two islands of the Lesser Antilles, *viz.*, Saint Vincent and Tobago.

Canada.—The exhibits sent by the Dominion of Canada were not, as our author remarks, on a scale at all commensurate with the importance of the wood or lumber industry. According to statistics given in the Scientific Review, the saw-mills of the Dominion represent a capital of 825 millions of francs, and more than 100,000 persons are engaged in the enterprise. Yet so far as the Exhibition was concerned, the most important contribution was a large map showing the polar limits of the principal trees of Canada.

Vancouver's Island, New Brunswick.—Specimens of the Douglass and Menzies pine were sent from the Island of Vancouver, while the forests of New Brunswick, which cover nearly a half of the whole territory, were more fully represented by a larger collection of indigenous woods.

British Guiana.—From the Colony of British Guiana, however, came a collection nearly as large as that sent by India. There are about 130 varieties of wood, many of them remarkable for their density and weight, in the virgin forest which occupies the centre of South America. There is no separate Forest Department in the Colony, and the collection of maps and special reports, to which our author attaches so much value, were wholly unrepresented.

Saint Vincent.—The smallness of the island of Saint Vincent did not prevent the Government of that Colony from sending a large number of logs of wood, model of huts and boats, &c. The variety of trees found in the forests resemble greatly those of British Guiana.

Tobago.—A similar remark may be made regarding the exhibits of Tobago. But although there is no regular Forest Department in this land, considerable care appears to be taken that the forests shall not be exhausted by excessive felling either for home consumption or exportation.

France.—We have hitherto been considering the contributions sent to the Exhibition by the Empire of India and the Colonial possessions of Great Britain. The forest resources of the various foreign countries which were represented, are now passed in review, and it is interesting to note the statistical information which is given as the heading of each chapter. Thus the whole surface of France is stated at 52,810,100 hectares,* of which 9,107,332 hectares, or 17 per cent. of the whole, are under forest.

The forests are thus divided—

State forests,	... ...	1,012,688 hectares.
Communal forests,	... ...	1,967,846 "
Private forests,	... ...	6,127,398 "

It must not be forgotten in this enumeration that the loss of Alsace and Lorraine deprived France of no less than 350,530 hectares of her finest forests.

At the time of the Exhibition in Edinburgh, the Direction of the Forests in France were engaged in forming a special display at the exhibition held the same year in Paris by the Union of the Decorative Arts. France was not, therefore, officially represented at the Exhibition, but the four classes of exhibits, namely, Manufactured and Rough Products, Instruments and Apparatus, Scientific Collections and Literature, had each their sev-

* Hectare = about 2½ English acres.

eral exponents in the French section, owing to the energies of private individuals. The readers of the "Indian Forester" will be interested in the discussion of the theory of the Comte des Cars relative to pruning. The little book written by the Count has passed through seven editions, and has been translated into English and German. A numerous collection of sections of branches, was forwarded to the Exhibition in illustration of the theory, advanced in this book. For the French Literature of Forestry we must refer our readers to Monsieur Reuss' book, but we cannot refrain from mentioning a new edition just published by Mons. L. Boppe of the Cours de Technologie Forestière, created at the Nancy School by H. Nanquette.

Germany.—The proportion of land under wood in Germany is placed by our author at 26 per cent. of the whole territory, thus—

Total surface,	...	...	54,052,164 hectares.
Surface wooded,	...	...	45,234,061 „

The exhibits sent by Germany to the Exhibition consisted principally of wood pulp, and forest seeds, but the library contained a large collection of forest works and scientific documents. Official administrative reports, relative to the management of forests, were sent by the Grand Duchy of Baden and the Principality of Hohenzollern-Ligmaringen.

Denmark.—The chief of the Danish Forest Department, Hofjägermester P. E. Muller, had apparently determined that the collections of Denmark should be worthy of himself, and worthy of his country. It was owing to his untiring energy, and scientific knowledge, that visitors to the Exhibition knew more of the forest work of Denmark than of any other European country. For in the last 30 years, the re-afforestation of the moors and heaths has raised the extent of the Crown forests from 39,740 to 46,040 hectares, and no less than 26,000 hectares of forests have been added to the total amount formerly existing, in the last 25 years. The present position of the country is given as under—

Total extent,	...	...	3,956,700 hectares.
Wooded area,	...	...	204,000 „

or 5 per cent. of the total territory.

The Royal forests are divided into 22 districts, administered under the orders of 3 Superior Forest officials, 22 District Forest officers, 64 Rangers and 266 Foresters and Forest Guards. The older forests are composed chiefly of beech and pitch pine, which account between them for 81 per cent. of the forest trees. Denmark consumes 1,217,545 cubic mètres of wood every year, and of this quantity, it imports 434,000 cubic mètres. The imported wood consists principally of pitch pine and fir, the home production not exceeding 10 per cent. of the wood consumed. To meet this demand, therefore, the 26,000 hectares of

land which we have said above have been re-afforested in the last 25 years are, or will be, almost exclusively, stocked with these trees.

The beauty of the specimens of wood, oak, beech, ash, willow, lime, sycamore, birch and pitch pine attracted the special attention of our author, as showing the vigorous growth of these important woods in the maritime climate of Denmark. We must again refer our readers to the book itself for the long list of literary works on Forest Culture, published by the Danish Government, and also for a description of the maps prepared by the Forest Department. Copies of the review of the work of the Moor Society were also printed in English, and distributed gratis to all who applied for them at the Exhibition.

Sweden.—Sweden contains 17,569,000 hectares of wood, or 24 per cent. of its total surface, which is given at 44,281,000 hectares. The principal exhibits sent consisted of wood pulp and forest seeds.

Norway.—Norway contains 31,819,500 hectares, of which 7,660,125 hectares, or 25 per cent. of the total territory, are under wood. It possesses a regular Forest administration, which contributed many specimens of sawn timber, herbaria, and forest tools, logs of both beech and oak were sent from the small town of Laurrig, which is situated in Longitude 10° E. of Greenwich, Latitude 50°.

A large wall map, prepared by M. Holmboe, showed the distribution of the forests of Norway, the nature of the woods, and the quantities of timber exported to the various countries of the world. This table gives the figure of wood annually exported, at 976,000 tons, or 1,104,104 cubic mètres.

Switzerland.—The extent of forest in Switzerland is 781,984 hectares, or 19 per cent. of the total area. The trees occupy, as we have said in another paper, sharply defined districts. Thus the larch is the characteristic tree of the Central Alps. Beech forms a pure forest at the height of from 400—900 mètres in the Jura and at 1,200 mètres in the Northern Alps, while the chestnut grows very exuberantly in the dividing range between Switzerland and North Italy. Our author particularly notices the admirable report of M. Landolt, Professor of Sylviculture at the Polytechnic School of Zurich, on the forests of Switzerland, a copy of which he sent to the Exhibition.

Italy.—The total territory of Italy contains 29,632,200 hectares, of which 5,956,650 hectares are under forest. The Inspector General of Forests, Cav. G. Comminotti, sent a number of reports on the principal forests of Italy, giving geographical descriptions of each, together with memoirs on the preparation of charcoal and statistics of yield from the different woods, with monographs on various trees, such as the Phœnix palm, &c.

United States of America.—In this large territory, comprising 946,400,000 hectares, are found the most varied species of

woods in the world, from the trees of the Boreal regions of the Great Lakes, to the tropical plants of Florida. The annual export of timber is stated to reach the value of 80 millions of francs, but the forests belong chiefly to the Colonists, and this figure is only reached by the complete sacrifice of the capital value. "All the parts of the forests easily accessible have been blindly devastated."

The chief contributions sent from the United States were a trunk of the *Sequoia sempervirens*, over 13 feet in diameter, 150 specimens of the woods of Florida, a series of articles relating to the preparation of maple sugar, and a collection of insects hurtful to the forests of North America.

Literature was represented by the official reports of Dr. F. B. Hough, a distinguished Botanist, who was appointed by the Government of Washington, to report on the extent of the mischief done to the forests of the country by indiscriminate felling, and who visited the Nancy Forest School, with the view of proposing to his Government remedial measures and the institution of a School of Practical Forestry. The book of the Comte des Cars on Tree Pruning, has been also translated by Professor Sargent of the Harvard College, Boston.

Japan.—Our author keeps the collection of Japan, which he confesses was for him a revelation, as a tit-bit for the last. "According to the opinion of all," he says the Japanese section was, with those of India and of Denmark, the most remarkable in the Exhibition. "What has specially struck the visitors to the Japanese section is its perfect order, for not only were the various articles which it embraced, ranged with method and irreproachable taste, but besides that, the nature and uses of each was indicated on a placard, written in English, always clearly expressed, and sometimes full of instructive details."

This is less to be wondered at, if we remember that forestry as an art, has been practised in Japan as well as China for hundreds of years, that the old rules, one of which forbade any one to cut down a tree without immediately replacing it by another, are still in force, and that the personal direction of the Japanese section was undertaken by M. Takri, the Director General of the Japanese Forests, who was accompanied by his Secretary M. Takasima, and by an interpreter.

The country of Japan, the total surface of which extends to 38,200,000 hectares, includes 11,866,625 hectares* of forest, of which 5,259,182 hectares belong to the State and 6,607,443 hectares to private individuals. The Empire extends from the 24th to the 51st degree of North Latitude, and owing to this reason, and the great variety of geological formation, it is possible to divide the country into five forestry regions. In

* Japan has adopted the metrical system. The hectare bears the name of cho, the are of tan.

these are comprised 199 kinds of forest trees, and 117 of smaller trees and shrubs. The distribution of these was carefully shown on two large forest maps, prepared for this purpose.

Monsieur Reuss has had the advantage of the companionships of M. Takasima, who is now, or was lately, a student at the Nancy Forest School. This part of the book is most carefully written, and is accompanied by appendices on the Japanese method of preserving woods, on the regulations of the Imperial Forestry School at Tokio, &c. We are able to confirm his most interesting description of the Japanese section in every particular. We feel, however, that we should do an injustice to the author, if we reproduced verbatim, and an abridgement would spoil the description, the result of his labours.

Monsieur E. Reuss has written a good book, and he has done a good work in rescuing from oblivion, so far as his countrymen are concerned, the record of the first exhibition, which was purely devoted to Forestry. We believe he will receive, as he has merited, the thanks of all readers of the "Indian Forester."

GEORGE CADELL,
Avenue Agassiz, Lausanne.

REPORT ON FOREST ADMINISTRATION IN THE HYDERABAD ASSIGNED DISTRICTS (BERAR) FOR 1885-86.*

FOREST conservancy in Berár pursues an uneventful career of prosperity, so that except for the continuous cheapness of fire conservancy, there is not much for us to note that will interest our readers.

The area of forests is as follows :—

	Sq. miles.
Demarcated State reserves, ...	1,110
District reserved forests, ...	436
Unreserved forests, ...	2,796
	4,342

As the forest boundaries are, as a rule, used for fire lines, they are consequently cleared at least once a year.

The following extract from the Government of India orders shows the excellent work now in progress in Berár under the Forest Survey :—

"Satisfactory progress was made in the work of Forest Surveys and in the preparation of maps, as shown by the fact that 241 square miles were topographically surveyed during the year on the 2-inch scale and 102 on that of 4 inches to a mile. A considerable advance has also been made in triangulation.

"The accurate survey of the Melghát elicited the fact that the

* By Lieut.-Col. G. J. van Someren, Conservator of Forests, with a review by the Resident, and orders of the Government of India.

boundary between Berár and the Central Provinces did not coincide with the line laid down on general and district maps, and it is proposed that an authoritative settlement of the boundary between the two Provinces be effected during the next surveying season."

The following extract from the Government of India orders regarding the necessity for working-plans is of general interest :—

"Colonel van Someren's remarks in paragraph 18 of his Report have been read with interest, and I am directed to remark that the careful and appropriate working of the Melghát Forests has not been questioned, and that the improvement, which is reported to have taken place in these once neglected and overworked forests, is noticed with satisfaction. But, nevertheless, till a regular working-plan has been made, based on a detailed study of its productive capacity, no guarantee exists that the forest property in question will be worked to the full extent of its means. That a valuable forest area, for the produce of which an active demand exists, can be underworked, as well as overworked, has been clearly shown of late by the detailed valuation surveys of forests in the School Circle of the North-Western Provinces, the outturn from which, it was found, could be considerably raised by reason of the larger resources which these investigations brought to light. The only guarantee that a forest is worked correctly lies in a systematic and pre-considered plan of operations; and, under these circumstances, it is noticed with satisfaction that the collection of data for a working-plan of the Bairagath forest has been taken in hand."

Regarding fire-protection, we read as follows in the Government of India orders :—

"Fire-protection in Berár has not been quite so successful as last year, and its cost has slightly increased, as may be gathered from the following comparative statement :—

Year.	Area attempted.	Failures.	Area protected.	Percentage of failures to area attempted.	Cost.		Proportion of area under fire-protection to total area of reserves, per cent.
					Per square mile protected.	Per acre protected.	
	Sq. miles.	Sq. miles.	Sq. miles.		Rs.	Pies.	
1885-86, ...	1,046	44	1,002	4	6	2	68
1884-85, ...	1,046	23	1,023	2	5	1½	68
Increase or decrease in 1885-86, ...	..	+21	−21	+2	+1	+½	...

"The greater expense of the year's fire-protection is attributable to heavy winter rains, which kept the grass green till very late in the season, and thereby rendered the burning of fire-traces more difficult than usual. Its smaller success was also, to some extent, due to the same cause, but it is believed that some of the fires were intentionally lighted by dismissed or punished servants of the Department."

The number of beasts grazing in the Government forests was as follows :—

Camels.	Buffaloes.	Cows and bullocks.	Sheep and goats.	Total.
78	1,04,546	5,73,981	2,13,292	8,89,897.

Regarding the collection of grazing dues, we read as follows in the Resident's review :—

"It is probable that the system of levying a general grazing tax will be before long definitely introduced into Berar in lieu of selling the grazing by auction, a plan which is generally condemned by the District Officers. It is believed that the change will be welcomed by the people, and will not be attended by loss of revenue."

The Conservator remarks as follows regarding natural reproduction :—

"There is little to be added to the remarks made last year. The Conservator very carefully inspected several of the reserves in Basim and Wun Districts and submitted separate reports on them. Everywhere natural production is healthy, allowance being made for the very poor soil in parts of the forests. Fire protection, immunity from the axe, and carefully-regulated light grazing during the rains in the reserves south of the Melghat, combined with broadcast sowing of seed, is telling, and will in time cover the land with much tree vegetation. In most of the districts, however, there is now a great scarcity of bamboos, and measures were taken to procure seed and to sow it in selected plots during 1886-87. A large quantity of seed has been got in, chiefly from other circles, and the operations undertaken will appear next year under cultural operations."

There are no plantations in Berár, and cultural operations appear to have been principally confined to planting out a few bamboos, mangoes, and to sowing broadcast with kháir, teak, mango, mohwa and bamboo; 4,416 acres being thus sown broadcast throughout the Province.

The Melghát forest is being opened out by roads.

There are no departmental timber works. The yield of the forests during the year is as follows, the produce being entirely removed by purchasers :—

	Timber.	Firewood and charcoal.	Total.
	c. ft.	c. ft.	c. ft.
State reserves, ...	9,672	43,456	53,128
District "	3,500	2,058	5,558
Unreserved forests, ...	267,606	267,509	535,115
Total in 1885-86, ...	280,778	313,023	593,801
" " 1884-85, ...	327,805	352,590	680,395

The summary of all the produce removed is as follows :—

		1884-85.	1885-86.	
Teak, ...	c. ft.	164,362	144,136	
„ goles, ..	No.	...	3,060	(Free grants).
Other wood, ...	c. ft.	163,443	136,642	
„ goles, ...	No.	...	531	Do.
Firewood, ...	c. ft.	352,590	198,559	
Charcoal, ...	„	...	114,464	
Bamboos, ...	No.	3,248,626	2,717,301	Including free grant of 2,000.
Grass, ...	Tons.	10,238	8,641	
Lac, ...	„	13	12½	
Teak leaves, ...	„	307	263	
Fruits, ...	„	855	705	
Gum, ...	„	1½	3½	
Miscellaneous, ...	„	91	21⅓	

"The financial results of the year's working were as follow :—

Class of Forests.	Receipts.	Charges.	Surplus.	Deficit.	Proportion of surplus to gross revenue in per cent.
	Rs.	Rs.	Rs.	Rs.	
State Reserves, ...	54,331	62,470	...	8,139	...
District „	1,72,605	45,049	1,27,556	...	...
Unreserved (or District) Forests, ...	93,111	51,516	41,595	...	...
Total in 1885-86, ...	3,20,047	1,59,035	1,61,012	...	50
„ 1884-85, ...	2,93,448	1,52,514	1,40,934	...	48
Increase in 1885-86, ...	26,599	6,521	20,078	...	2

"The reserves have yielded the main portion of the year's revenue, the net surplus placed to their credit amounting to nearly Rs. 1,20,000. The serious falling off in the revenue realised from the unreserved forests is not explained.

"The gross revenue was got in from the following sources :—

	Rs.
Timber, ...	71,872
Firewood and charcoal, ...	26,046
Bamboos, ...	28,736
Grazing and fodder grass, ...	1,72,254
Other minor produce, ...	15,235
Confiscated, drift, and waif wood, ...	1,642
All other sources.	4,262
Total, ...	3,20,047

"The following statistics per acre of forest are useful for comparison with results in other provinces :—

Yield in timber and wood of all kind.	Gross revenue.	Charges.	Net revenue.	Cost of fire conservancy.	No. of beasts grazing.
Cubic foot.	Pies.				
·2	22	11	11	2	·3

REPORT OF FOREST ADMINISTRATION IN BALUCHISTAN 1885-86.*

THE progress of forest administration in Baluchistan is naturally slow in a country harried by wandering droves of camels and flocks of sheep and goats owned by Pathans, amongst whose ideas that of any possible necessity for protecting or restricting their grazing grounds cannot be reckoned. The fact is that constant warfare and feuds prevent population and flocks and herds from increasing beyond the limits which unprotected forest and grass tracts may provide for, but as soon as the British Government substitutes peace for feuds, the former forest resources of the country are drained to a degree hitherto unprecedented. Railways and buildings are constructed, traders proceed in safety from place to place, and the flocks and herds of the villagers increase rapidly.

Thus, unless the available forest area is speedily demarcated and protected from fires, and grazing restricted, the immediate result of the introduction of strong Government into a formerly lawless country, is the disappearance of the forests. In Baluchistan, it appears that at the first Land Settlement, the natural forest areas in the plains were given up for the unrestricted use of the zemindars, and have been practically destroyed as forests during the few years Baluchistan has been under British rule.

It may be still possible, however, to create State grass reserves in the Thalli jungles, and the Government of India strongly advises this procedure. As a Forest Law for Baluchistan has now been promulgated, it is to be hoped that the constitution of Government reserves in the pistachio forests of Pishin, and in the tamarisk forests of Talai, and the Ziarat juniper forests, will be no longer delayed.

Mr. Lace, who writes the report, has given a map of the juniper forests, which extend at altitudes between 9,000 to 11,000 feet over the hills to the west of Quetta, at an average distance as the crow flies of 40 miles, though there is a small

* By J. H. Lace, Esq., Assistant Conservator of Forests, with review by Col. Sir Oliver St. John, K.C.S.I., Agent to Government of India in Baluchistan, and orders of Government of India.

tract of juniper forest at Urak at about 16 miles from Quetta. These distances, in a hill country, are of course very greatly increased by the windings of the paths.

Mr. Lace's interesting notes on juniper reproduction are as follows :—

"*Note on the Juniper (Juniperus excelsa).*—In previous reports in which the juniper has been mentioned doubts have been generally expressed as to whether it reproduced itself by seed, and the Ziarat forest has been said to be effete and had ceased to yield good seeds; these opinions have probably been expressed after a short and too rapid examination of various juniper tracts, for after a careful search in various parts of the country where the juniper grows best, I have found seedlings of all ages from those just germinated up to 10 years of age.

"*Fruit.*—The first appearance of male catkins, I have noticed, has been in July, and that of female catkins in the middle of August; the pollen is shed in April, and the fruit ripens in October of the year following that in which the catkins first appear, and falls between October and February, some of it persisting on the trees until March and April.

"*Germination.*—Germination of the seed takes place in April, and is more or less abundant according to the amount of snow or rain that has fallen: owing to the rocky nature of the ground on which most of the juniper grows, germination is chiefly confined to the space protected by the branches of the parent-tree, and which is covered to a good depth by the detritus of the leaves; I have, however, seen a few seedlings, about two years old, growing in open spaces between the trees.

"*Seedlings.*—A great number of the seedlings die, no doubt, from drought soon after the germination; that is the case I find this year (1886) with the seedlings that germinated in April; but in 1885 the rainfall was unusually great, and seedlings of that year are now to be found under most of the large trees, where they are protected from goats and sheep by low, sweeping branches.

"I cannot say that the goats and sheep eat the young juniper as a rule, because I do not think they care about eating juniper if there is anything else to be got, and there is usually plenty of underwood (berberis, lonicera, caragana, cotoneaster, &c.) in the juniper forests that they prefer; however, these flocks ramble over the hills for five or six months during the year, and during the heat of the day herd under the trees; and in some cases find fresh grass under their shade, and it is to this that I attribute the disappearance of many seedlings that germinate early in the spring: I have hunted under many trees where the marks of goats were apparent without finding a single seedling, unless a few low, trailing branches on perhaps one side have protected two or three.

"As an example I give the result, detailed below, of a careful examination in April 1886 of the ground round five trees, taken at random; on a hill near Ziarat, situation north, elevation about 8,000 feet—

Six seedlings two years old commencing to branch; five one year old, and a number with their rudimentary leaves just appearing above ground.

(2). Four seedlings one year old, and a few that had just germinated.

(3). Eight seedlings one year old, and one from three to four years old.

(4). Four seedlings one year old, one from three to four years old, and ten of various ages whose height varied from 1 foot 8 inches to 4 feet 10 inches.

(5). Seventeen seedlings one year old and two three years old.

"The above seedlings were all directly under the shelter of the parent-trees, and the old ones under No. (4) had been evidently retarded in growth by too much shade.

"Between Ziarat and Chista, at Khushki, and between Ziarat Chari and Chautir, where the best portions of the juniper forests lie, there are numerous young seedlings.

"On Zerghun, where the juniper is more stunted than at Ziarat, I found very few seedlings in July 1885.

"It is by no means uncommon to see an old juniper tree surrounded by six or seven seedlings that are endeavouring to force their way through the lower branches of the parent-tree, but which are in a bad state of vegetation owing to want of light; many young trees die, no doubt, in this struggle for existence, or their tops die off and one or more of the lower branches grow up in place of the original main stem; but there is no doubt that the juniper has a great power of persisting for years under the shade of the parent-tree, and it grows extremely slowly during that time.

"*Growth.*—The growth of the juniper is undoubtedly very slow; during the first year of its life the chief growth is in the root; seedlings one year old measure 1 to 1¼ inches above ground, with roots 8½ to 9¾ inches long; two seedlings 3 years old measured 2¾ and 4 inches above ground, with roots 1 foot 1 inch and 1 foot ½ inch long, respectively.

"Almost all the oldest juniper trees are rotten in the lower part of their trunks, so it is difficult to get a clear and sound transversal section of large diameter upon which to count the rings, the following sections have, however, been obtained, and will give some idea of the rate of growth:—

Mean diameter of section.	Rings.			Average No. of rings per inch of diameter.
	Heart-wood.	Sap-wood.	Total.	
Inches.				
23·50	129	71	200	8·51
14·00	105	81	186	13·28
11·50	109	68	177	15·39
14·00	131	72	203	14·50
19·00	166	109	275	14·47

"*Timber.*—A considerable quantity of juniper wood has lately been

used for building purposes at Ziarat; but it is an inferior timber for building, there being so much waste in it, almost all trees of any size are more or less rotten at the bottom and full of pockets of rotten wood, so that beams and even planks of any size have to be patched up; besides which the trunk of the trees are very irregular in shape, which leads to a great loss of wood when the logs are squared. Regarding the yield of timber per tree, I have gathered the following data, which may be considered approximately correct:—97, selected trees of an average girth and length of 6 feet 1 inch and 38 feet 9 inches, respectively, yielded 2 127 planks containing 3,768·75 cubic feet, and 128 beams and bullies (about 256 cubic feet) or a total of 4,024·75, which gives an average per tree of 41½ cubic feet of timber. Of the trees felled the largest in girth was 11 feet 6 inches, and the highest 62 feet.

"*Yield per acre.*—At present I can give no reliable figures as to the average yield of wood per acre; the forest varies in character every few hundred yards, and individual trees are of every conceivable shape."

A good deal of planting is being carried on at Sibi and near Quetta, but does not appear to have hitherto been very successful.

The climate appears to be rather severe for *Pinus longifolia*, over a maund of seed of which was sown in May 1885, and germinated freely, but many of the plants were killed by the frost in the winter of 1886. Some plants of this species, referred to in the previous year's report, are doing well.

The following extract on the cultural operations in Baluchistan from the orders of Government of India is much to the point:—

"The cultural operations in Baluchistan, interesting in their way, are as yet of minor importance, though it is now apparently considered possible to secure sufficient water, in connection with the Shebo and Barshore irrigation schemes, to form artificial plantations of a workable size. It is presumed, however, that this proposal, which might involve a large outlay, will not be entertained without a minute previous investigation of every circumstance bearing on the scheme. The subject may be specially noticed in the next report."

So is the remark on fencing, which Sir Oliver St. John considers a possible necessity in forest management in Baluchistan:

"It is possible that fencing may have to be resorted to in a few specially exposed localities, but to require it on any large scale would probably involve a prohibitive cost, such as would be in no sense warranted by the condition of the forest revenues in Baluchistan, or by the circumstances of the forests. The protected forest lands in Ajmere are not in all respects like the Baluchistan tracts, being smaller in extent and in a condition of infancy, with growing seedlings and young trees dispersed over whole area. Fencing has, on the other hand, rarely been found necessary for extensive forest tracts containing a large proportion of adult trees, from which the cattle are kept out by herdsmen, just as in the case of cultivated land."

The scarcity of fuel, and the extreme urgency of reserving every possible source of this necessity of life in a cold country, is shown by the following extracts :—

"More fuel than usual was purchased and brought into Quetta depôt, but it was not found impossible to retail the wood at less than 12 annas per maund owing to the loss incurred by dryage.

"A lakh of maunds of firewood was supplied through the department to the Commissariat, and a royalty realised thereon.

"There was a considerable decrease, compared with last year, in the amount of fuel removed from forests by purchasers, and this was due to the Sibi forests not being able to meet the demand, as almost all the wood fit for fuel has been cut. A considerable quantity of firewood was imported by contractors from Sind.

"The increase in receipts is chiefly due to a royalty being taken on firewood supplied to the Commissariat; if, however, a royalty had been realised on all firewood required by departments during the year, either at Quetta or elsewhere, the deficit would have been changed into a considerable surplus: for instance, the Executive Engineer, Quetta Division of the Sindh-Pishin Railway, collected a total of 52,168 maunds at Quetta, Bostan, and Kuchlak, which would have realised, at one anna per maund, a sum of Rs. 3,260; the Murree Brewery Company also collected firewood on which no royalty was charged; the reason that no royalty was charged in these cases was because a good deal of the wood had been already brought in and contracts made, before the Agent to the Governor-General gave any orders on the subject.

"A satisfactory result of the year's administration is the large decrease that has taken place in the deficit. The financial results for the last three years compare as follow :—

Year.	Receipts.	Charges.	Deficit.
	Rs.	Rs.	Rs.
1883-84, ...	4,752	16,911	12,159
1884-85, ...	6,089	13,266	7,177
1885-86, ...	14,962	15,798	836

III. NOTES, QUERIES AND EXTRACTS.

THE BOX.—*Nomenclature.*—This is the *Buxus sempervirens*, the evergreen, or common box tree of Linnæus. The word "buxus" is derived from *paknoe*, dense, in reference to the hardness and closeness of the wood; or, perhaps, to the denseness of the foliage. The Greeks called the boxes made of this wood, which were highly esteemed for their durability, *pyxide*, and hence probably arose the word *pyx*, which is used for the chest containing the host, in the Roman Catholic Church.

It is the *bois commun* and *bois beni* of the French, and the *Buchsbaum* and *Buxbaum* of the Germans.

Geography.—The box is a low evergreen tree, a native of Europe and the temperate parts of Asia, and, according to some authorities, of Britain, growing to the height of 15 feet to 30 feet. The tree is found in a wild state between 31 degrees and 52 degrees of North Latitude, on mountains, and spreading as undergrowth among other trees; but never forming forests entirely by itself. The largest collection of wild box trees in Europe is in the forest of Ligny, in France, and in that of St. Claude, on Mount Jura; but in both cases the box trees are mixed with trees of other species. Box trees are also found in forests of other trees, in several parts of France, particularly in Franche Compté, Dauphiné, Haut Provence, the chain of mountains stretching across Languedoc, and the Pyrenees.

The box tree is produced abundantly in Turkey and on the shores of the Black Sea; but a great proportion of the boxwood of commerce sold in the European markets as Turkey box is grown in Circassia and Georgia, whence it is brought to Odessa, and shipped for Europe.

The box tree is found in various parts of Persia, India, China, Cochin-China, and, according to some, in Japan.

In England the box tree is a doubtful native. It grows plentifully upon Box Hill, near Dorking, in Surrey. In a lease of this land, dated 25th August, 1602, the tenant covenants to use his best endeavours for preserving the yew, box, and all other trees growing thereupon; as also to deliver, half-yearly, an account of what hath been sold, to whom, and at what prices. The receipt of box trees cut down in 1608 upon the sheep-walk on this hill amounted to £50. At present the only habitat of this tree in England is at Box Hill, and, though this circumstance cannot be considered as a proof that it is not indigenous,

yet, as it is well known that it does not ripen its seed freely in this country, and seldom sows itself, either on Box Hill or anywhere else, when in a neglected state, we may fairly be allowed, when these circumstances are taken into consideration, and conjoined with its Roman name, to doubt whether it be a native.

History.—The box tree appears to have been first mentioned by Theophrastus, who ranks the wood with that of ebony, on account of the closeness of its grain. Pliny describes it as being as hard to burn as iron, as producing no flame, and as being totally unfit for charcoal. Vitruvius, Pliny, and Ovid allude to it for topiary work, or its wood for musical instruments, and the name of the tree being synonymous with that of flute. Virgil calls it:

> "Smooth-grained, and proper for the turner's trade,
> Which curious hands may carve, and steel with ease invade."
>
> Dryden's *Virgil.*

The wood of the tree has been in use for turnery from the earliest ages, and for wood engraving since the fifteenth century.

Description.—The wood of the box is remarkably heavy, weighing, when newly cut, 80 lbs. 7 oz. per cubic foot, and, when perfectly dry, 68 lbs. 12 oz. It is the only European wood that will sink in water; it is yellow, very hard, and susceptible of a high polish. The wood was formerly much used in England in cabinet-making and inlaying, as it still is in France; and also, in both countries, for musical and mathematical instruments, combs, and various articles of turnery. The principal use of the boxwood is for wood engraving, and for this purpose it is an important article of commerce.

The boxwood used by cabinet-makers and turners in France is chiefly that of the root. The town of St. Claude, near which is one of the largest natural boxwoods in Europe, is almost entirely inhabited by turners, who make snuff-boxes, rosary beads, forks, spoons, buttons, and numerous other articles.

The wood of some roots is more beautifully marbled or veined than others; and the articles manufactured vary in price accordingly. The wood of the trunk is rarely found of sufficient size for blocks in France, and when it is, it is so dear that the entire trunk of a tree is seldom sold at once, but a few feet are disposed of at a time, which are cut off the living tree as they are wanted.

There are in the forest of Ligny generally many stumps which have been treated in this manner.

Boxes, &c., formed of the trunk, are easily distinguished from those made of the root, by the wood of the trunk always displaying a beautiful and very regular star, which is never the case with that of the root.

Seasoning.—Boxwood is very apt to split in drying; and, to prevent this, the French turners put the wood designed for their

finest works into a dark cellar as soon as it is cut, where they keep it from three to five years, according to circumstances. At the expiration of the given time, they strike off the sapwood with a hatchet, and place the heartwood again in the cellar till it is wanted for the lathe. For the most delicate articles, the wood is soaked for 24 hours in fresh very clear water, and then boiled for some time. When taken out of the boiling water, it is wiped perfectly dry and buried, till wanted for use, in sand or bran, so as to be completely excluded from the light and air. Articles made of wood thus prepared resemble in appearance what is called Tunbridge ware.

Engraving blocks.—The wood used for engraving purposes is chiefly imported from Turkey or Odessa, and sells in London at a very high price. Its use has been much on the increase since the repeal of the paper duty and the development of illustrated literature. In 1832 the duty alone on this wood amounted to £1,867 17*s.* 4*d.* In France the native trees are seldom of sufficient size for wood engraving, and wood is largely imported from Spain. The box trees which were cut down on Box Hill in 1815 produced upwards of £10,000.

The art of cutting on wood was first practised between the years 1400 and 1430, it being first applied to books of devotion and playing cards. It was essentially a German invention, the wood engravers being called *Formenschneiders*. Until the time of Bewick, the celebrated English wood engraver, the blocks were cut in the manner of boards from the tree, the engraved lines mostly running with the grain of the wood. At the above date the custom of cutting the trunk into sections about 1 inch in thickness was adopted; the advantages of this mode are such that engraving on wood has largely superseded engraving upon copper and steel. The large engraving blocks used for the principal illustrated papers are formed, or built up, in pieces of various sizes. This is a special trade, and one in which the greatest judgment and skill are exercised. On completion the face of the blocks is smoothed or polished and prepared with powdered white lead and water, upon which the artist makes his drawing, the business of the engraver being to cut away the white parts, and leave the black lines of the artist's pencil in relief.

Concluding Remarks.—The great demand for boxwood, not only for wood engraving, but for turnery, tools, mathematical instruments, &c., is pressing so heavily upon the supplies from Europe and the Black Sea districts, that other markets are being sought, prominent in which is our Indian Empire, where considerable quantities are found in a wild state. The experiments in this direction have not been successful, owing to the expense of winning it from its native haunts, conveying it to the sea-coast, and transporting it to England. The samples of wood reaching our market from this Eastern source have not

been felled and treated with the same care as those regularly coming into this market from Turkey; this, coupled with the additional cost of getting it to the European market, has caused the experiments to result in little better than loss, but it is an undoubted fact, as the old source of supply becomes weaker, that the Indian box wood will assume a prominent place in the trade.—*Timber Trades Journal.*

Extract from the "Gardeners' Chronicle," Vol. I., Third Series, No. 1, (1st January, 1887,) page 21 :—

TRANSMISSION OF SEEDS FROM THE TROPICS.—Mr. Hart's note (p. 756, Vol. XXVI.) goes a long way beyond the assertion of M. Thiery (see p. 497), the latter pointing out that in the tropics, seeds of European plants lose their vitality much sooner than in Europe, which seems precisely what might be expected to happen, although the difference as, for instance in the case of the seeds of cabbage, *viz.*, eight months in the tropics and eight or ten years in Europe, and peas, four months against four years must be unusual.* Mr. Hart, however, seems to recommend hermetically sealed packages or packets for all seeds sent to the tropics, and condemns the paper bags generally used. Our experience at Kew, is of course, of a different nature from that of any one in the tropics, but we receive thousands of packages of seeds of all kinds annually from all parts of the world, and we send to the tropics almost as many. The safest and most successful method of packing to adopt for seeds sent from Kew to the tropics, and *vice versâ*, is therefore a matter of much interest here. Seeds badly harvested are not likely to stand a long journey, no matter how they are packed, but if gathered at the proper time, carefully dried and stored till ready for sending away, we believe the great majority of seeds travel best in paper packets, and these in a canvas bag, if to be sent by post. Large quantities of seeds may be sent in an ordinary box, but they should be stowed in a dry place on boardship. Seeds of an oily nature ought to be packed in damp soil as soon as they are ripe, and if the journey is not very long, they will grow when taken out of the soil and placed under favourable conditions. Even oily seeds will sometimes bear exposure to air and drought without suffering. We lately received from Demerara, a quantity of seeds of *Hevea spruceana*, which arrived quite dry, having been sent in an ordinary box; I believe every one of those seeds germinated, very much to our surprise. Palm seeds of all kinds, except, perhaps, *Nipa fruticans*, travel well if sent in ordinary canvas bags. The Right Hon'ble Sir M. E. Grant-Duff, late

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* Seeds of kidney beans, kept for two years in Jamaica, germinated freely when sown; peas are supposed to retain vitality at least as long as these do in England, *viz.*, three to five years.

Governor of Madras, has forwarded thousands of packets of Indian seeds of all kinds to Kew within the last four years, and these were all packed dry, the packets (paper) being first bundled and enclosed in card-board to keep the seeds from being injured in the post, and then rolled in a canvas or paper wrapper. The bulk of these seeds have been sent on from Kew to the Colonies, but almost every one of those kept at Kew, germinated well. Sir F. Von Mueller, also sends many kinds of seeds from Australia, always in paper packets and almost always successfully. Certainly at Kew, we have every reason to prefer the paper packet and canvas bag to all other wrappers for use in the transmission of seeds generally to the tropics. With regard to the preservation of imported seeds, the circumstances here at Kew are the reverse of those referred to by M. Thiery and Mr. Hart. The difficulty of preserving tropical seeds in England must be less than that of preserving European seeds, such as peas, beans, &c., in the tropics. We do not require to keep many tropical seeds for any length of time, seldom more than a year, except in the case of cucurbits and cacti, but we do not find that seeds kept in paper packets in a drawer, where the atmosphere is dry and the temperature about 60° in winter, lose their vitality within that time. Exceptional cases are of course excluded; there are many kinds of seeds which perish almost as soon as they get dry. The most important point of all in connection with the transmission and preservation of seeds is dryness without roasting, and a regular temperature at all times. For small packages of seeds, the post is the safest and best means of transmitting them, and canvas bags or paper packets the best of all wrappers. How long a seed will remain good when kept in a seed-room depends on, whether it is oily or starchy, oily seeds perishing in a short time, such being tea, coffee, camellia, theobroma, walnuts, Brazil-nuts, &c. It is, however, impossible to draw a line between long-lived and short-lived seeds, as they are affected by many conditions, perhaps not perceptible to us, or altogether beyond our control. It is not pretended that the Kew method is the best possible, but so far as experience shows a better one has not been devised yet. I am afraid Mr. Hart's hermetically sealed packages would only add considerably to the labour and expense of seed packing without making any difference in the preservation of the seeds; on the contrary, we frequently find that seeds thus packed suffer much more than they would do if sent in bags of paper or canvas.—W. WATSON, Kew.—*Proceedings of Agri-Horticultural Society of Madras.*

GIRDLING TREES FOR FRUIT.—The "Fruit Grower, published by Chas. A. Green, of Rochester, N. Y., is commercial in character, hence it finds its way westward by the sack-full. In the last number the following note appears:—

"Professor Budd writes: A Mr. J. B. Spaulding, of Illinois, has practised ringing for fruit for years past. His plan was at first to girdle every other tree, but he now treats all alike. He rings in the latter part of April, taking off a ring of bark from the stem one-half inch in width entirely around the tree, taking care not to injure the cambium layer under the bark. He begins to girdle when the trees are but six years old. So far he has found no harm in the process. The gain is that it sets them to bearing at once, and they bear full, too."

This is followed by a sharp criticism. "Yes," he says, "they bear full. I have seen trees girdled by mice that were loaded with nubbins heavy enough to satisfy the most ravenous grower, but the trees died young. Just how to girdle a tree and not injure the cambium layer is not stated, and seems to be a delicate operation. I am opposed to girdling, and advise all readers not to thus mutilate their trees." All of this, and much more of the same general tenor, is unfair and intended so to be. We have never recommended indiscriminate girdling of fruit trees to bring them into bearing, and have never advised girdling in any form for the States east of Lake Michigan. Possibly, at some time. I have used nearly the words quoted in regard to Mr. Spaulding's extended work in girdling trees, but always in connection will be found the advice to confine the operation to such refractory varieties as Yellow Bellflower, Perry Russet, Walbridge, and often the Tetofsky, when growing on rich drift prairie soils. We have tens of thousands of Walbridge trees in Inowa of large size to-day which have never borne a peck of apples to the tree. Every one of them should be carefully girdled about the middle of next June. If they do not blossom and hold their fruit the succeeding spring, girdle them again in a new place.

If the operation is successful, and in nine cases out of ten it will be, the operator will find that this kind of girdling does not bring the "nubbins" that Mr. Green speaks of in connection with the girdling by rabbits and mice, but it will bring an abundant crop of nice fruit.

That it might shorten the life of the trees to some extent is probable, but the wound soon heals over, and if not repeated too often it does not specially lower the vitality of the tree. At this time Mr. Spaulding's great orchard at Springfield, Illinois, looks quite as well as those of his neighbours which have not been girdled, yet his pockets have been well filled with orchard proceeds when theirs, during the recent trying seasons, have been mainly empty.

Yet we do not recommend girdling such varieties as Duchess, Wealthy, Roman Stem, or farther south, such as Ben Davis, Jonathan, Dominie, Grimes, Golden, or anything else that bears in a respectable way at proper age. But the varieties of apple, pear and cherry, which fail to set fruit on our rich soils,

even when they blossom freely, should be girdled year after year until they come into bearing. To illustrate the mode of doing the work, and its results, the following example is given. A friend pointed out two trees of Tetofsky standing on rich garden soil, of large size, which he said never bore but two apples. We said: "Why don't you girdle them to-day." "I will," he replied, "if you will show me how."

It was then the 10th of June, and of course the bark peels freely. A ring of bark three-quarters of an inch in width was taken off entirely around the stem about one foot above the ground. He said he thought it would kill the trees, but to-day the only trace of the operation is a roughened break in the bark of the stems; but the whole expression of the tops of the trees was changed. Prior to the operation the trees had a growthy, forest tree expression. Now the annual growth is short and the branches are lined with fruit spurs. The year after the ringing, the trees were loaded with fine fruit, and they have not failed to bear a fair crop since.—*By* PROF. J. L. BUDD.—*Farmers' Review.*

SABE, SABAI, OR BABUI GRASS* (*Andropogon involutus*).—Mr. Clarke, Secretary to the Chamber of Commerce, addressed the Society in reference to Sabai grass, making the following inquiries:—

1. Where the grass is grown?
2. Whether it can be procured in large quantities?
3. The purposes for which it is used?
4. Whether it is exported in quantities?
5. To what market it is exported?

A number of members of the Society in different districts were referred to, and answers have been received from Dr. Hill, Purulia; Mr. H. Dear, Monghyr; Mr. Gibbon, Bettiah; Mr. Dalgleish, South Darbhanga; Mr. Gale, North Darbhanga, and Mr. Slack, Giridhi; while others are still expected. The letters will be printed in the Journal for future reference. Their substance is embodied in the following reply to Mr. Clarke:—

As I am now in possession of somewhat fuller information regarding the Sabai grass, regarding which you addressed this Society on the 11th instant, I have now the pleasure of replying to you at somewhat greater length. In your letter of inquiry you refer to the grass as being exported largely from Tirhoot, but my inquiries confirm the opinion I ventured to express in my note of the 12th instant, that *Sabé* is not a product of that district, but is imported from the foot of the Nepál Hills. The consumption of the grass in the form of string, varies with the

* Can this grass be the same as the *Bhabar* grass of the Lower Himalayas and Siwaliks (*Pollinia eriopoda*), which is largely used for rope making, and we believe for paper manufacture at Lucknow? Mr Duthie could afford the necessary information if supplied with specimens.—[ED.]

distance from the source of supply. It is very little used in the south of Darbhanga District, and very largely used in the northern portion of Chumparun. In the latter district it is grown to some extent on the land bordering on Nepál. Locally the grass is used only for making into string, but last year the grass in the part of the district referred to, was bought up for export, and the whole has this year been secured.

The grass exported from Chumparun last year went directly to the Bally Paper Mills.

In the Monghyr District the grass is grown all over the Kharakpur range of hills, it is exported thence to Patna and other neighbouring markets, and large quantities would be available. The local price is about Re. 1-14 per maund. The only purpose for which it is used is for making into string, and it is sold both as string and in its unmanufactured state.

The grass is grown also on the Rajmahal Hills.

In Chota Nagpur the grass, known there as Babúi, is in some parts *cultivated*, it is grown in Manbhúm District, especially in Burrabhúm and Patkúm in Singbhúm, and in the Bhúskar jungle in sub-division Jamtara, Nya Dúmka District; large quantities may be procured; manufactured into string it is sold at Rs. 3-2 to 3-12 per maund, and exported to Bankúra, Raniganj and Calcutta. The raw product, it is said, is not exported, but can be purchased in February to May at from 12 annas to a rupee a maund. The only use to which it is put is in making string.

In none of the districts is the grass used for any purpose but making string for many varied uses.—*Proceedings of Agri.-Horticultural Society of India.*

Wood Spirit, or Pyroxylic Acid.—In reply to "S. A. L.," when wood is subjected to destructive distillation, a number of complicated products are formed varying with the nature of the wood and the temperature. If the wood contain azotised principles ammonia will be formed. If the object of distillation be chiefly for the sake of the charcoal, whitewoods are placed in iron retorts, which are gradually heated to redness. The volatile products consist of gases and vapours; among the former are carburetted hydrogen, carbonic acid, carbonic oxide, &c. The vapours condense into liquid or solid products; some of the liquids are soluble in water, such as pyroxylic acid, or wood spirit, pyroligneous acid, &c., and the insoluble products forming tar and certain oily substances. Tomlinson says, wood spirit is an important substance, and resembles alcohol in its affinities, forming an ether and a series of compounds exactly corresponding with those of the vinous spirit. Like alcohol, wood spirit is regarded as a hydrated oxide, of a body corresponding with ethyle, and which like, that body, has not been isolated, it is

called methyle. Wood spirit is contained in the acid liquor or wood vinegar produced by the distillation of wood, and is separated by distillation, the first portions which pass over being set aside. The acid liquor does not probably contain more than 1 per cent. of spirit. A portion of the acid liquor comes over with the spirit, and this is neutralised by means of hydrate of lime, and the clear liquor separated from the oil which floats on the surface. When pure, wood spirit is a thin colourless liquid, with a peculiar odour unlike that of alcohol, and it has a hot, disagreeable taste; it boils at 152 degrees Fahr., its density is ·798 at 60 degrees, and the density of its vapour is 1·12. Wood spirit mixes freely with water, and, like alcohol, dissolves the resins and volatile oils, and is often a cheap substitute for spirits of wine for that purpose. It may also be burnt in a spirit lamp, but it emits a peculiar odour which is apt to produce headache.—*Timber Trades Journal.*

FUNGI ON ROOTS OF TEA BUSHES.—Messrs. Jardine, Skinner and Co. forwarded some roots of tea bushes with the accompanying letter:—

"We send herewith roots of tea bushes that have died off on forest land on the Duars.* The bushes thrive well for a time, then suddenly wither, and it is noticeable that in every, or nearly every, instance the bushes that die are adjacent to decaying stumps of trees felled when the land was cleared of forest. The bushes are from 2 to 3 year old, and as a rule, do well in the soil of the garden.

"Perhaps Dr. King or Mr. Wood-Mason would kindly favor us with their views as to the probable cause of the bushes dying. Can it be fungus from the decaying stumps and roots of the forest trees?"

The roots were sent to Dr. King, who very kindly furnished the following report:—

I have carefully examined the diseased tea bushes sent to me with your letter of 18th instant, and I have submitted them to Dr. D. D. Cunningham who makes vegetable blights a special study. The result of Dr. Cunningham's examination of the specimens is, that the root bark has in them all been completely destroyed by a minute fungus. It is extremely likely that this fungus originated in the dead and decaying stumps which your correspondents say abound in the garden from where the bushes come. But whatever may have been the origin of the blight, it is infectious; and all tea bushes affected by it should be rooted up and carefully burnt. Beyond this precaution I can suggest no remedy.—*Agri. and Horticultural Society of India.*

* This dying off of tea bushes round dead stumps was noticed in Assam in 1874 by undersigned.—[ED.]

TABASHEER.—Mr. Dyer in his article on 'Tabasheer' in "Nature," of February 24th (p. 396), throws out the suggestion that the silica deposited in the joints of bamboo may have undergone a process of dialysis. It may be of some interest to him and to your readers generally, to learn that plates of transparent compact silica ($Si\ O_2$) may be formed by dialysing the basic sodica silicate. Four or five years ago I discovered this, and succeeded in producing plates a quarter of an inch in thickness and 4 inches in diameter, by placing the basic silicate of soda within a dialyser, which was floated on dilute sulphuric acid, 1 part to 20. The plate of silica was formed in the floated vessel. A similar result may be obtained by placing in a wide test-tube a portion of basic silicate. Taking care that the upper portion of the tube is quite free from adhering silicate, the dilute acid should be poured on to the surface of the silicate without disturbing it. After a few hours the silica is eliminated in a crystalloid form.

Possibly the first process may help us to understand how tabasheer may have been deposited, while the second may throw some light on the formation of raphides, carbonic or some other acid being the active agent.—THOMAS ROWNEY.—*Nature.*

FOREST ORGANIZATION FOR BEGINNERS.

ERRATA ET ADDENDA.

Vol. XI.—November No.

Page 5, lines 22 and 23, omit "the scale of the two must be the same but."
Page 5, line 5 from bottom, *for* "mainly," *read* "also."

Vol. XII.—January No.

Page 1, after Section "III., Assessment," insert "Chapter V."
" 3, line 4, after "roots of trees," insert "which have been cut down."
Page 4, line 8 from bottom, insert above "(5) cubic contents," "Chapter VI."

Vol. XII.—February No.

Page 5, lines 5 and 6, *for* "sum of the heights of all trees," *read* "average height of the trees."
Page 8, line 20, *for* "area," *read* "areas."

Vol. XII.—March No.

Page 6, line 5 from bottom, *for* "40th," *read* "25th."
" 6, line 4 from bottom, *for* "77th," *read* "45th."
" 6, line 2 from bottom, *for* "67," *read* "30."
" 6, last line, *for* "116th," *read* "48th."

Vol. XII.—May No.

Page 2, line 17, *for* "period, or next two periods at most (10—40 years)," *read* "two periods or three periods at most (20—60 years)."
Page 3, line 12, after "coppice" insert "Chapter VII."
„ 7, line 5, *for* "period," *read* "periods."
„ 8, line 14, *for* "$I = a.h.f - ahf'$," *read* "$I = a.h.f. - a'h'f'$."

Vol. XII.—June No.

Page 3, at top, insert "Chapter VIII. Determination of age and station."

Vol. XII.—July No.

Page 1, *for* "Chapter V.," *read* "Chapter IX."
„ 1, line 2, *for* "last Chapter," *read* "Chapters V.—VIII."
„ 5, line 11 from bottom, *for* "Chapter VI.," *read* "Chapter X."

Vol. XII.—August No.

Page 12, line 11 from bottom, *for* "suffice," *read* "suffices."

Vol. XII.—September No.

Page 1, line 1, *for* "Chapter VI.," *read* "Chapter XI."
„ 3, line 16, *for* "41—60," *read* "41—60 and over."
„ 6, *for* "Chapter VII.," "*read* Chapter XII."
„ 12, line 11, *for* "1500," *read* "2000."
„ 13, line 3, *for* "this period," *read* "the period."

Vol. XII.—November No.

Page 1, line 4, *for* "Chapter VIII.," *read* "Chapter XIII."
„ 8, line 8, *for* "these," *read* "this."
„ 8, line 9, *for* "substitutes are procurable," *read* "substitute is procurable."
Page 11, line 17, *for* "Chapter IX.," *read* "Chapter XIV."
„ 12, line 13 from bottom, omit "class."
„ 12, line 14, *for* "yield per yield acre," *read* "yield per acre."
Page 19, line 11 from bottom, *for* "1883," *read* "1888."
„ 19, line 9 from bottom, *for* "1884," *read* "1888."
„ 19, line 7 from bottom, *for* "1885," *read* "1888."
„ 23, *for* "Chapter X.," *read* "Chapter XV."
„ 24, *for* "Chapter XI.," *read* "Chapter XVI."

We regret that the notice below was not received sooner, and hope that in future years we may receive notice of the Examination at least 6 months before it actually takes place.

FOREST SERVICE IN INDIA.

1. An examination will be held in June 1887, when not less than ten probationers, *if so many be found duly qualified*, will be selected to undergo a special training to qualify them for admission to the Forest Service of India.

2. An applicant must be a natural-born British subject, and must be above 17 and under 21 years of age on the 1st of June, 1887. He must be unmarried, and if he marry before leaving this country for India he will forfeit his appointment.

3. Any person desirous of competing at this examination must send to the Revenue Department of the India Office, on or before the 1st day of May, 1887—

(*a*). His name and parentage; a certificate, or other satisfactory evidence, of the date of his birth; and a statement of consent from parent or guardian.

(*b*). A statement of the places of education at which he may have been since he was nine years old, accompanied by testimonials of good conduct during the last four years. He must also pay a fee of £4 by means of a special stamp, according to instructions which will be communicated to candidates.

4. Applicants will have to appear before a Medical Board* at the India Office, at a date to be hereafter named. Particular stress will be laid upon good vision and hearing, and means will be taken to test physical powers of endurance, so as to ensure the selection of persons of active habits and sound constitution.

5. The subjects of examination, and the marks assigned thereto, are detailed in the following table :—

	Maximum.	Minimum.
(1) Orthography, ...	300	150
(2) Handwriting, ...	200	100
(3) English Composition, ...	200	67
(4) Intelligence, ...	100	...
(5) Arithmetic, in all its branches, ...	300	100
(6) Geometry, including 1st to 4th and 6th Books of Euclid, ...	300	100

* With a view to prevent parents and guardians from incurring the inconvenience and expense of preparing candidates who may be physically unfit for the Forest Service, it is suggested that candidates be submitted to examination by the medical adviser of the family, or any other qualified medical practitioner, with regard to the following points :—

(1). A weak constitution.
(2). Defective vision.
(3). Impaired hearing
(4). The existence of any congenital defect.

It is to be understood that this private examination is merely suggested to lessen the chances of disappointment, and that it is by no means intended to take the place of, or to influence in any way, the official examination.

On the subject of the standard of eyesight required for the Indian services, a pamphlet has been published, under the authority of the Secretary of State in Council, by Messrs. Churchill & Sons, 11, New Burlington Street.

	Maximum.	Minimum.
(7) Algebra, up to and including Binomial Theorem, Arithmetical and Geometrical Series, Interest and Annuities, ...	300	100
(8) Logarithms, including use of Tables, ...	100	33
(9) Plane Trigonometry, up to and including Solution of Plane Triangles, and Calculation of Heights and Distances, ...	300	100
(10) Mensuration, ...	100	33
(11) Elements of Mechanics, ...	300	75
(12) Elements of Physics, omitting Electricity and Magnetism, ...	300	75
(13) Inorganic Chemistry, ...	400	133
(14) Mechanical Drawing of Geometrical Figures (limited to the drawing of Plane Figures)	400	80
(15) Elements of Botany, ...	400	100
(16) French or German { Translation, ...	200	67
(16) French or German { Oral, ...	200	33

6. The above subjects are compulsory; but, in addition thereto, the annexed marks may be obtained in the following optional subjects:—

Translation into French or German, the language being the same as that taken up under the compulsory subjects, ...	100
Freehand Drawing, ...	300
Elements of Geology and Mineralogy, ...	300

7. From those competitors who attain an amount of marks not less than the minimum, and satisfy the requisite conditions in other respects, the Secretary of State will select those whom he may deem best adapted to the Service.

8. The candidates so selected will undergo a course of training extending over two years and two months. During the first 22 months, commencing with the annual session which begins in September 1887, they will prosecute their studies at Cooper's Hill College, where arrangements have been made for instruction in Forestry and in the necessary auxiliary sciences. During the last four months the candidates will be instructed, under suitable supervision, in such English or Continental forests as may be selected for the purpose. Short tours will also be made during part of the College vacations. The entire expense of the tours and of the practical instruction will be defrayed by the Secretary of State for India in Council.

9. An annual charge of £180 is made for each student, which must be paid in advance to the Bank of England, in three sums of £60 per term, the total charge being £360. Receivable orders, with full directions as to the mode of payment, will be forwarded from the India Office, shortly before the fees fall due, to the parents or guardians of the students.

10. A deposit of £5 is required to be paid by each student on admission to the College, as caution money, to cover charges incurred by him for damage to books, instruments, &c., or any College bills outstanding on leaving the College, when the balance standing at his credit will be repaid. This deposit is to be paid with the fee for the first term, making the total payment on that occasion £65

11. The College fees include all charges for tuition, board, according to the College tariff, and lodging, with washing, but not for medical attendance. Students are required to provide their own class

books and drawing instruments. Drawing paper, drawing boards, and surveying instruments are provided by the College.

12. Every student will be required to conform to the College rules, to exhibit due diligence in his studies throughout his course, and to give evidence of satisfactory progress; failing which, or in the event of serious personal misconduct, he will not be allowed to remain at the College.

13. The Rules regarding the course of study and other matters may be learnt from the College prospectus.

14. Every student, before proceeding to India, will be required to furnish to the President satisfactory evidence of his competency in riding.

15. During the course of training, the proficiency of the students will be tested by periodical examinations; and, on the termination of their studies, there will be a final examination, when, in the event of the results being satisfactory, and provided the Medical Board give a favourable certificate as to health, candidates will be nominated Junior Assistant Conservators in the Forest Department in India, their seniority being regulated by the result of all the above examinations combined.

16. Within a month of his nomination as Junior Assistant, each nominee must sign Articles of Agreement describing the terms and conditions of his appointment. He must embark for India when required to do so by the Secretary of State, who will provide for the expenses of his passage. Failure to embark at the stated time will lead to forfeiture of appointment.

17. The pay, &c., of the Forest Service may be gathered from the following table; it must, however, be clearly understood that the allowances vary in different Presidencies, and are liable to revision:—

		Per mensem. Rs.
Inspector General of Forests,		1,700 to 2,000
Conservators of Forests,	1st grade,	1,500
	2nd „	1,250
	3rd „	1,000
Deputy Conservators of Forests,	1st grade,	900
	2nd „	800
	3rd „	650
	4th „	550
Assistant Conservators of Forests,	1st grade,	450
	2nd „	350
	3rd „	250

18. The pay of a Junior Assistant Conservator (Rs. 250 per mensem) will commence from the date of arrival in India.

19. The young Officer will be required to report himself to the Government of India (or to the Government of Bombay or Madras, in case he should be sent to one of these Presidencies), or to such Local Government as may be specified, and he will then be posted to such place as the Service may require.

20. Promotion, leave, and pension will be regulated by the Rules for the time being; but an Officer will not be eligible for promotion or increase of pay until he has passed an examination in such Native language as the authorities may prescribe.

TESTIMONIAL TO HUGH CLEGHORN OF STRAVITHIE, M.D., LL.D., F.R.S.E.*

At a Meeting of Foresters and others, held at Edinburgh on the 2nd of August, 1886, it was unanimously resolved to present Dr. Hugh Cleghorn (on the occasion of his retiring from the Presidency of the Scottish Arboricultural Society) with some mark of the great esteem in which he is held by his numerous friends at home and abroad, and as a recognition of the valuable services he has rendered to Forestry and other Sciences during many years.

Dr. Cleghorn's long and distinguished career in the Public Services in India—first in the Army Medical Department, and afterwards as a pioneer in the organizing and directing of the Forest Department—is so well known and highly appreciated, that it is not necessary to enter into details, although the services he then rendered merit the highest recognition. Since his retirement from the Public Service, some sixteen years ago, no one has done more to promote the best interests of Forestry in the British Empire, and to educate and train the Foresters of our day in the true principles of Forest Science.

While pre-eminently a leader and guide in Forestry, he has at the same time given valuable aid in various other branches of Science; especially in connection with Education, Botany, and Agriculture. It is therefore with every confidence that the Committee solicit the hearty co-operation of his friends and the public generally, so that the Testimonial may be worthy of the occasion, and a fit recognition of the eminent services Dr. Cleghorn has rendered in the course of a long lifetime.

JOHN M'LAREN, Jun.,
Secretary.

Subscriptions may be remitted on or before 1st May *to the Honorary Treasurer,*

5 St. Andrew Square,
Edinburgh, *March* 1887.

James A. Wenley, Esq.,
Bank of Scotland, Edinburgh.

The following Noblemen and Gentlemen have been constituted a Committee to carry out the object in view.

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* We regret to state that although the subscription list for this testimonial to Dr. Cleghorn has been open for several months, that we were only informed of it quite recently, but there is still we hope time for any friends of Dr. Cleghorn in India to subscribe, although it is stated above that the 1st May is the last day admissible.

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